GEOLOGICAL SURVEY OF CANADA.
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY.

VOLUME 1.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.,

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY.

PART III.

5. The Fossils of the Devonian Rocks of the Mackenzie River Basin.

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The Third Part, herewith presented, of the "Contributions to Canadian Palæontology," consists of an illustrated report on all the fossils now in the Museum of the Survey from the Devonian Rocks of the Mackenzie River basin, and especially on those collected by Mr. R. G. McConnell, in the years 1887–90, both inclusive.

It consists of fifty seven pages of text, illustrated by six full page plates, lithographed by Messrs. Mortimer & Co., of Ottawa, from original drawings made by Mr. L. M. Lambe, the artist to the Survey.

The Fourth and concluding Part, which will consist of a similar report on the Fossils of the Devonian Rocks of Manitoba, is now in course of preparation.

ALFRED R. C. SELWYN.

GEOLOGICAL SURVEY DEPARTMENT,
OTTAWA, May 1st, 1891.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

5. *The Fossils of the Devonian Rocks of the Mackenzie River Basin.*

In 1887, 1888 and 1889 large and important collections of fossils were made by Mr. R. G. McConnell from the Devonian rocks exposed along the Hay, Mackenzie and Peace Rivers. A detailed report upon the species contained in these collections was written, and the five plates required to illustrate it were printed off, in the fall of 1890. Before the manuscript of this report was sent to the printer, however, the receipt of an additional collection of fossils, made by Mr. McConnell in 1890 from the Devonian rocks of the Athabasca and Pembina Rivers, induced the writer to enlarge its scope so as to include therein a consideration of all the specimens now in the Museum of the Survey from the Devonian rocks of the Mackenzie River Basin. The whole of the specimens referred to in these pages were collected by members of the Staff of the Survey between the years 1875 and 1890, both inclusive, and some of the collections made prior to 1885 have been provisionally reported upon by the writer, in the Reports of Progress of the Survey for the years in which they were made. In the study and comparison of many of the species represented in these collections, and especially in ascertaining the internal structure of the corals and the minute peculiarities of the polyzoa, the writer has been ably assisted by Mr. L. M. Lambe.

SPONGIÆ.

ASTRÆOSPONGIA HAMILTONENSIS, Meek and Worthen.

Plate 28, figs. 1, 1a.

Astræospongia Hamiltonensis, Meek and Worthen. 1866. Proc. Chicago Ac. Sc., vol. I, p. 12.

Astræospongia Hamiltonensis, Meek and Worthen. 1868. Geol. Surv., Illinois, vol. III, p. 419, pl. 10, fig. 6.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: the

solitary six rayed spicule figured, which is somewhat doubtfully referred to this species. It appears to be about one third smaller than the figured spicules of the typical *A. Hamiltonensis*, the former being about two millimetres in its maximum diameter and the latter about three in theirs. Isolated spicules precisely similar to that of the Hay River *Astræospongia* are found in the Hamilton Formation at Thetford and at Bartlett's Mills, near Arkona, Ontario.

ANTHOZOA.

ALCYONARIA.

AULOPORA SERPENS, Goldfuss.

Tubiporites serpens? Schlotheim. 1820. Petrefact., pt. 1, p. 367.
Aulopora serpens, Goldfuss. 1826.* Petref. Germ., vol. I, p. 82, tab. xxxiii, fig. 2.
" " Rominger. 1876. Geol. Surv. Mich., Foss. Corals, p. 86, pl. xxxiii, fig. 2.
" " Walcott. 1884. Palæont. Eureka distr. Nevada, p. 103.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen parasitic upon *Atrypa reticularis*.

This little coral seems to be in no respects dissimilar to the fossils from the Hamilton Formation of Michigan and from the Lower Devonian of Gray's Canon in the Eureka district of Nevada, which have been referred to *A. serpens* by Dr. Rominger and Mr. Walcott. It is, however, not yet certain that the specimens from these three localities are precisely identical with the species described by Schlotheim and Goldfuss.

The systematic position of the genus *Aulopora* has long been doubtful and is still far from settled. In their monograph of the British Fossil Corals (1850-54), Edwards and Haime refer it to the *Alcyonaria*, but in their subsequently published "Polypiers Fossiles des Terrains Palæozoiques" they create for it the special order *Zoantharia Tubulosa*, composed of the single family *Auloporidæ*, and place both between their *Tabulata* and *Rugosa*. Nicholson, in the last edition of his Manual of Palæontology (1889) refers *Aulopora* to the *Alcyonaria*, but Ferdinand Rœmer, in the Lethea Geognostica (1876) places it at the end of the

* Rœmer (Lethea Geognost., 1, 521) gives the date of this species as 1825, and Edwards and Haime (Polyp. foss., p. 312) as 1829. The first volume of the Petref. Germaniæ bears date 1826-33.

Zoantharia under the heading "incertæ sedis," and Zittel in his "Handbuch der Palæontologie" (1883) quotes it in an appendix to the *Zoantharia* under the title "Genres du Groupe des Tabulata et Tubulosa E. and H. de position systématique incertaine."

ZOANTHARIA.

STREPTELASMA RECTUM, Hall.

Plate 27, figs. 1, 1a and 2.

Strombodes rectus, Hall. 1843. Geol. N. Y., Surv. Fourth Distr., pp. 209-210.
Cyathophyllum rectum, Edwards and Haime. 1851. Polyp. foss. Terr. Palæoz., I, p. 372.
Streptelasma recta, Hall. 1876. Illustr. Dev. Foss., pl. xix, figs. 1-13.

Mackenzie River, ten miles below Bear River, R. G. McConnell, 1888: three specimens which seem to agree with the descriptions and figures of this species.

CYATHOPHYLLUM ARCTICUM, Meek.

Cyathophyllum arcticum, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 79, pl. xi, fig. 8.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: two good specimens, which correspond fairly well with Meek's description of one of the forms of this species. Mr. Meek, however, expressed the opinion that *C. arcticum* "resembles *C. quadrigeminum* of Goldfuss, as figured on pl. xviii, fig. 6b of his Petrefacta Germaniæ, more nearly than any other species" with which he was acquainted. In the writer's judgment, the two specimens collected by Mr. McConnell are much more like *C. hexagonum*, as originally described and figured by Goldfuss, and subsequently by Edwards and Haime, the Sandbergers, Ferdinand Rœmer and others, if, indeed, they are not actually identical therewith. Both specimens are small convex masses of intimately connected, polygonal and for the most part hexagonal corallites, the apertures of the larger ones measuring as much as fifteen millimetres in their maximum diameter. The number of septa is essentially the same as those of *C. hexagonum*, but in the specimens from the "Ramparts" the writer has not been able to detect any traces of the paliform lobes on the septa, which, according to Edwards and Haime, "form a very distinct crown round the centre of the calice" in *C. hexagonum*.

CYATHOPHYLLUM CÆSPITOSUM, Goldfuss.

Plate 27, figs, 7, 8.

Cyathophyllum cæspitosum, Goldfuss. 1826. Petref. Germ., vol. I, p. 60, tab. xix, fig. 2.
Cyathophyllum hexagonum (pars.) " " Ibid. tab. xix, figs. 5a, b, c. (cæt. excl.)
Caryophyllia dubia, DeBlainville. 1830. Dict. Sc. Nat., vol. LX, p. 311. Man., p. 345.
Cyathophyllum cæspitosum, Milne Edwards. 1836. 2nd ed. Lamarck, vol. II, p. 428.
Cyathophyllum cæspitosum, Lonsdale. 1840. Geol. Trans. 2nd ser., vol. V, pt. 3, pl. lviii, fig. 8.
Cyathophyllum cæspitosum, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somerset, p. 9, pl. iii, fig. 10.
Cladocora Goldfussi, Geinitz. 1845-46. Grundr. der Verst., p. 569.
Diphyphyllum cæspitosum, D'Orbigny. 1850. Prodr. de Paléont., vol. I, p. 106.
Cyathophyllum cæspitosum, Edwards and Haime. 1851. Polyp. Foss. des Terr. Palæoz., p. 384.
Cyathophyllum cæspitosum, McCoy. 1851. Brit. Palæoz. Foss., p. 69.
" " " Edwards and Haime. 1850-54. Brit. Foss. Corals, p. 229, tab. li, figs. 2, 2a, 2b.

Peace River, near the mouth of Little Red River, Prof. Macoun, 1875: a small mass of loosely aggregated corallites. Hay River, forty miles above its mouth, R. G. McConnell, 1887: a few single corallites, two of which are figured. These very closely resemble what Goldfuss calls the "coni segregati" of *C. hexagonum*, and figures as such on tab. xix, figs. 5a, b, c, of the "Petrefacta Germaniæ," though Edwards and Haime have shown that these are forms of *C. cæspitosum*. Their internal structure is essentially the same as that of the mass of compound corallites from the Peace River, but it is just possible that the specimens from the Hay River may be single corallites of Meek's *C. arcticum*.

CYATHOPHYLLUM RICHARDSONI, Meek (Sp.)

Plate 27, figs. 3 and 4.

Aulophyllum? Richardsoni, Meek. 1868. Trans. Chicago Ac. Sc., vol. 1, p. 81, pl. xi, fig. 3.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: six good specimens.

Although Mr. Meek placed this species provisionally in the genus *Aulophyllum*, he expressly stated that he was quite uncertain whether it ought to be referred to that genus or to *Cyathophyllum*. On this point his exact words are as follows:—"I know this coral only from fragments less than 0,80 inch in diameter, none of which shew the entire length. They are also nearly all considerably compressed, but this seems to be from accidental pressure. The generic characters cannot be made out with much confidence from such materials, and hence I am by no means satisfied that the species should not be called *Cyathophyllum Richardsoni*. As near as its internal structure can be determined, however, from the specimens collected, it would seem to differ from that genus in having an inner wall encircling the central region, and thus more nearly approaching the genus *Aulophyllum*. It also wants the transverse tabulæ generally more or less developed in the central region of *Cyathophyllum*."

The specimens upon which Mr. Meek's description was based, which are also from the "Ramparts," have been kindly lent to the present writer, for examination and comparison, by Mr. C. D. Walcott, of the U. S. Geological Survey. Their internal structure, it may be stated, is in a peculiar and not very good state of preservation. In those of which sections have been made, the appearance of a supposed "inner wall encircling the central region" seems to be due to the fact that the matrix filling up the vesicles of a narrow outer zone which corresponds in breadth to the length of the secondary septa, happens to be of a distinctly darker colour than that which fills up the vesicles of the central portion of the coral. In these and in the much better specimens collected by Mr. McConnell, the writer has failed to find any indications of an "inner wall" like that of *Aulophyllum*, and has consequently been induced to refer the species to *Cyathophyllum*.

In longitudinal sections the specimens obtained by Mr. McConnell shew that from the bottom of the calyx to the base of the coral the primary septa extend to the centre, where they are slightly twisted. There are no tabulæ proper, but the spaces between all the septa are everywhere filled with vesicular tissue, the vesicles being larger and less regular in the central area than they are exteriorly. The most perfect specimen collected, which measures about three inches in length, has its epitheca densely and finely striated across, in addition to the ordinary surface markings.

CYATHOPHYLLUM ATHABASCENSE. (N. Sp.)

Plate 32, figs. 1, 1a, b.

Corallum simple, elongate-turbinate and slightly curved: epitheca well developed, marked with rounded and not very prominent longitudinal ribs, which are much broader than the grooves between them, and by transverse striæ or wrinkles and an occasional constriction caused by an arrest of growth. Calyx circular, rather deep, with steep sides: septa about thirty four in number, simple, not bearing arched carinæ on their sides and apparently not denticulated at their summits. Interior structure, as seen in longitudinal sections, consisting of an outer or peripheral zone of oblique ascending rows of rather large vesicles, and of a broad central area in which the interstices between the septa are crossed by large curved dissepiments, whose size, shape and disposition are very irregular. Transverse sections made a little below the base of the calyx shew that the thirty four septa extend almost to the centre, and that they are all equal in length.

Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: three good specimens.

The largest of these is strikingly similar in shape and in surface markings to the *Cyathophyllum ceratites* of Goldfuss as figured by the Sandbergers on plate xxxvii of their memoir on the fossils of the Devonian rocks of Nassau, but in *C. ceratites* there are said to be from sixty to one hundred and twenty subdenticulated septa.

CAMPOPHYLLUM ELLIPTICUM.

Plate 27, figs. 5, 6.

Chonophyllum (*Ptychophyllum*) *ellipticum*, Hall and Whitfield. 1873. Twenty-third Rep. Reg. N. York. St. Cab. Nat. Hist., p. 233, pl. ix fig. 13.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: three specimens, each of which has been slit longitudinally through the centre and the cut surfaces polished.

On treating in the same way a specimen of a coral from the Devonian shales at Rockford, Iowa, recently forwarded for comparison by Dr. H. G. Griffiths of Burlington, in that State, and labelled by him *Chonophyllum ellipticum*, the writer was surprised to find that its internal structure and external characters are essentially the same as those of

the specimens from the Hay River. In all four there is no satisfactory evidence of the existence of "infundibuliform cups," but the internal structure, as represented in fig. 6, consists of a broad central tabulate area surrounded by an outer and rather narrow peripheral zone composed of large vesicles. The tabulate area occupies about three fifths of the entire diameter, the tabulæ are close-set, flat and for the most part continuous, and their outer terminations are bent abruptly downward. In the outer vesicular zone the general direction of the rows of vesicles in the interseptal loculi is upward and outward. A transverse section of the specimen represented by fig. 6, made at a distance of about half an inch from the bottom of the cup, shows that the primary septa reach nearly if not quite to the centre, and the secondary ones a quarter of the way.

In their description of *Chonophyllum ellipticum* Professors Hall and Whitfield say that "there may be some doubt as to its generic relations." If the specimen from Rockford, forwarded by Dr. Griffiths, be correctly referred to that species, its internal structure would seem to show that it is congeneric and even perhaps conspecific with the *Campophyllum Soetenicum* of Schluter,* from the Middle Devonian of the Eifel.

A single specimen of a rather elongated and narrow variety of this species has since been collected (in 1890) on the Athabasca, thirty miles below Red River.

Heliophyllum parvulum. (N. Sp.)

Plate 27, figs. 9, 9a and 10.

Corallum small, simple, either nearly straight, subconical and not much longer than broad, as in the specimen represented by fig. 9, or somewhat bent, irregularly distorted in growth and proportionately rather narrower, as in the original of fig. 10, but apparently never either slender or narrowly elongated. Calyx circular in outline, moderately deep: septa thirty-six of each kind, at least in the broader of the two specimens figured, their edges, as seen in the cup, presenting a toothed appearance, which is due to the passing over them of arched carinæ: primary septa reaching nearly to the centre at the bottom of the cup: secondary septa very short and feebly developed: septal fossette lateral, shallow. Epitheca thin, transversely striated and

* Anthozoen des Rheinischen Mittel-Devon, Berlin, 1889, p. 39, taf. iii., figs. 1-6.

wrinkled, with an occasional rather deep constriction, and marked also with longitudinal, rib-like markings which correspond to the septa within.

Internal structure, as seen in a longitudinal section through the centre of each specimen, consisting of a narrow central tabulate area, surrounded by a broad, external zone of vesicular tissue. The tabulate area occupies about one fifth of the entire diameter, and the tabulæ are straight, regular and closely arranged. In the outer vesicular zone the vesicles are slightly smaller and more regularly disposed towards the outside than near the centre, their general direction being in rows which curve obliquely upward and outward. The general direction of the arched carinæ which cross the sides of the septa throughout their entire length, on the other hand, is uniformly upward and inward.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two perfect and well preserved specimens, both of which are figured.

Phillipsastræa Hennahi, Lonsdale.

Astræa Hennahi (pars), Lonsdale. 1840. Trans. Geol. Soc. Lond., Ser. 3, vol. V, p. 697, pl. lviii, fig. 3.
Astræa Hennahi, Phillips. 1841. Pal. Foss Cornw., Dev. and W. Somers., p. 12, pl. vi, fig. 16.
Smithia Hennahi, Edwards and Haime. 1851. Polyp. Foss. des Terr. Pal., p. 421.
Arachnophyllum Hennahi, McCoy. 1851. Brit. Pal. Foss., p. 72.
Smithia Hennahi, Edwards and Haime. 1853. Brit. Foss. Cor., p. 240, pl. liv, fig. 4: Meek, 1877, U. S. Geol. Expl. 40th Par., vol. IV, p. 32, pl. ii, figs. 6 and 6a.

Peace River, near Vermilion Falls, Professor Macoun, 1875, two specimens, and R. G. McConnell, 1889, three specimens, one of which measures fully seven inches in its greatest diameter. Hay River, forty miles above its mouth, R. G. McConnell, 1887: five specimens.

Those from the Hay River are very variable in external form, no two of them being exactly alike. In one the corallum is "depressed and moderately convex below," as in the type of *Smithia Verrillii*, Meek; in another the basal portion is so deeply conical that the entire depth of the coral is nearly equal to its maximum breadth at the summit, while a third is nearly spherical. The epitheca, which is beautifully preserved in the deeply conical specimen, has its outer surface finely and concentrically striated. The calices of the corallites, whose

outer walls are conspicuously elevated, average about three millimetres and a quarter in diameter. They are placed at distances apart equal to from once to twice their own breadth, and their septa average eleven or twelve of each kind.

P. Hennahi occurs, though rarely, in the corniferous limestone of Ontario. Three specimens which appear to be identical with it are in the Museum of the Survey, two labelled "Woodstock, A. Murray," and the other "Cayuga, E. De Cew," each of which must have been collected more than twenty years ago.

Phillipsastræa Verrillii, Meek. (Sp.)

Smithia Verrillii, Meek. 1868. Trans. Chicago Ac. Sc., vol. 1, p. 83, pl. xi, figs. 7a-b.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two specimens.

This coral seems to differ from the preceding species in the much less elevated outer edges of the calices of its corallites. Its calices, also, appear to be smaller and somewhat more distantly arranged than those of *P. Hennahi*, the average diameter of those of *P. Verrillii* being not quite two millimetres, and their septa usually eight or nine of each kind.

Pachyphyllum Devoniense, Edwards & Haime.

Pachyphyllum Devoniense, Edwards and Haime. 1851. Polyp. Foss. Terr. Palæoz., p. 397.

Pachyphyllum Devoniense, Edwards and Haime. 1854. Mon. Brit. Foss. Corals, p. 234, pl. lii, figs. 5 and 5a.

Peace River, between Vermilion Falls and the mouth of Little Red River, Professor Macoun, 1875: a single specimen whose internal structure corresponds much better with Edwards and Haime's diagnosis and figures of this species than with Hall and Whitfield's description of *P. Woodmani*, or with authentic examples of the latter coral from Iowa.

The specimen from the Peace River is an irregular convex mass, about ten centimetres or four inches in its maximum diameter, of compound corallites, which have no definite walls. The calices are

strongly exsert and project considerably above the spaces between them. They average seven millimetres in diameter, and are separated by depressed spaces which in some places are wider than the calices themselves and in others narrower. Externally, the resemblance of the specimen to *P. Woodmani* is not inconsiderable. Transverse and longitudinal sections of both, however, show that the Peace River coral differs from *P. Woodmani* in that its corallites have no definite walls and no central tabulate area, as those of *P. Woodmani* have, and in its non-confluent costæ and septa which extend almost to the centre.

Cystiphyllum Americanum, var. arcticum.

Cystiphyllum Americanum, var. arcticum, Meek. 1868. Trans. Chicago Ac. Sc., p. 80, pl. xi, fig. 6.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one specimen.

Pachypora cervicornis, De Blainville. (Sp.)

Calamopora polymorpha, var. *ramoso-divaricata*, Goldfuss. 1829. Petref. Germ., vol. I, p. 79, pl. xxvii, figs. 3a, 4a, 4b and 4c, (cæt. excl.)
Calamopora spongites, var. *ramosa*, Goldfuss. Ib., vol. I, p. 80, pl. xxviii, figs. 2a-2g. (cæt. excl.)
Alveolites cervicornis, De Blainville. 1830. Dict. Sc. Nat., p. 369, t. lx.
Alveolites reticulata, De Blainville. Ib., p. 369.
Favosites cervicornis, M. Edwards and Haime. 1851. Polyp. Foss. des Terr. Palæoz., p. 243: and (1853) Brit. Foss. Corals, p. 215, pl. xlviii, fig. 2 (?).
Favosites reticulata, M. Edwards and Haime. 1851. Polyp. Foss. des. Terr. Palæoz., p. 241: and (1853) Brit. Foss. Corals, p. 215, pl. xlviii, figs. 1, 1b.
Favosites polymorpha, Billings. (Pars.) 1859. Canad. Journ., N. S., vol. IV, p. 3 fig. 9.
Favosites polymorpha, Meek. 1868. Trans. Chicago Ac. Sc., vol. 1, p. 86, pl. xi, fig. 10.
Pachypora cervicornis, Nicholson. 1879. Struct. and Affin. Tabul. Cor. Palæoz. Per., p. 82, pl. iv, figs. 3, 3 a-d.

Peace River, between Vermilion Falls and the mouth of Little Red River, Prof. Macoun, 1875, and R. G. McConnell, 1889. Hay River,

forty miles above its mouth, R. G. McConnell, 1887, and Mackenzie River, at the "Ramparts," R. G. McConnell, 1888. A few well preserved portions of branches of a coral which is somewhat doubtfully referred to this species, from each of these localities. These vary in thickness from half an inch to an inch and a half. In some the corallites are very small and in others comparatively large, but the lips of the calices are invariably thickened by a secondary deposit of sclerenchyma. Their apertures, which are often closed with opercula, are usually nearly or quite circular in outline, but they vary considerably in shape, those of one specimen, in particular, being transversely elliptical, with an obtusely conical protuberance at the base of each.

Lindstrom (Ovfersigt af Konigl. Vetensk. Akad. Forhandl., 1873, p. 22) and Ferdinand Rœmer (Lethaea Geognostica, 1883, Bd. 1, p. 435) claim that this species is the *Madreporites cristatus* of Blumenbach (1803), and that the proper name for it is *Pachypora cristata*, Blumenbach (Sp.). Edwards and Haime, on the other hand, had previously identified the *Madreporites cristatus* with a Wenlock limestone species, and in this view they are followed by Nicholson in his "Tabulate Corals of the Palæozoic Period."

Alveolites vallorum, Meek.

Alveolites vallorum, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 86, pl. xi, fig. 9.

Hay River, forty miles above its mouth, R. G. McConnell, 1887, two specimens; Mackenzie River, at the "Ramparts," R. G. McConnell, 1888, four specimens; and Peace River, at Vermilion Falls, R. G. McConnell, 1889, one specimen.

Alveolites Rœmeri, Billings.

Alveolites Rœmeri, Billings. 1860. Canadian Journal, New Series, vol. V, p. 255.
" " Nicholson. 1874. Rep. Palæont. Prov. Ontario, p. 54.
Cladopora Rœmeri, Rominger. 1876. Geol. Surv. Michigan, Foss. Corals, p. 50, pl. xx, fig. 3.

Peace River, near Vermilion Falls, Professor Macoun, 1875, eleven specimens, and R. G. McConnell, 1889, one fragment.

HYDROMEDUSÆ.

HYDROIDA.

ACTINOSTROMA WHITEAVESII, Nicholson.

Actinostroma Whiteavesii, Nicholson. 1891. Ann. and Mag. Nat. Hist., vol. VII, Sixth Ser., p. 320, pl. ix, figs. 3 and 4, also woodcut, fig. 2, in text.

Peace River, near the mouth of Little Red River, Professor Macoun, 1875: two specimens.

ECHINODERMATA.

CRINOIDEA.

ARACHNOCRINUS CANADENSIS. (N. Sp.)

Plate 28, figs. 2 and 2a.

Calyx (or dorsal cup) very small, hemispherical and about one fourth broader than high. Underbasals small, apparently rhomboidal, but partly covered by the column: basals rather large, four pentagonal and one hexagonal, the height and breadth of each being about equal: radials a little broader than high, slightly larger than the basals, nearly hexagonal, the upper or outer angle of each hexagon being truncated and concavely excavated for the reception of the base of the first brachial, though the articulating scar of each radial does not occupy more than one half of the entire diameter of the plate: first brachials subquadrangular in outline and about twice as broad as high: second brachials five sided, much broader than high, their bases broad, their lower or inner sides short and slightly divergent, and their upper and outer sides shallowly concave: beyond this the characters of the arm plates are unknown. Anal plates two, both five sided with unequal sides, the first or lowest one about as broad as high, with a narrow base, and the second or upper one broader than high, with a broad base. Dome plates unknown: surface of the calyx smooth.

Approximate dimensions of the only specimen collected, which is a little distorted: height of the calyx, up to the base of the first brachials, six millimetres; greatest breadth of the calyx, eight mm.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen.

At the suggestion of Mr. Wachsmuth, who has examined the specimen, this interesting little crinoid is here provisionally referred to Meek's and Worthen's genus *Arachnocrinus*, though it appears to the writer to differ therefrom in having two small and simple anal plates and not one comparatively large one, which in *Arachnocrinus* is said also to support "a lateral tube which is in line with the arm bases."

VERMES.

Spirorbis omphalodes, Goldfuss.

Plate 28, figs. 3, 4, 4a, 5 and 5a.

Serpula omphalodes, Goldfuss. 1826-33. Petref. Germ., vol. 1, p. 225, pl. lxvii, fig. 3.
Spirorbis omphalodes, Nicholson. 1874. Rep. Paleont. Prov. Ont., p. 121, fig. 54a.

East bank of the Clearwater River, a few miles below the mouth of the Pembina, Professor Macoun, 1875, and A. S. Cochrane, 1881: five or six specimens, adherent to *Orthis striatula*. Hay River, forty miles above its mouth, R. G. McConnell, 1887, and Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: a few specimens which vary considerably in shape at different stages of growth, and which are always attached to brachiopods or corals.

In small specimens (such as the original of fig. 3) the outer volution is rounded and somewhat depressed and the umbilicus usually, though not always, comparatively wide. In large individuals (fig. 4) the outer volution is elevated and subangular and the umbilicus narrow. The surface is usually smooth or nearly so, but in some specimens (fig. 5) which seem to be nearly intermediate between this species and the next, the umbilical margin is seen to be distinctly plicated, when examined under a lens.

Spirorbis Arkonensis, Nicholson.

Spirorbis Arkonensis, Nicholson. 1874. Rep. Paleont. Prov. Ont., p. 121, figs. 54 b, c.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen attached to the dorsal valve of *Spirifera cyrtinæformis*.

Cornulites (Ortonis) sublævis. (N. Sp.)

Plate 28, figs. 6. 7.

Tube minute, conical, slender, slightly flexuous and attached through out its entire length to some foreign body: aperture circular. Surface, as seen under a lens, nearly smooth and marked only with fine transverse lines of growth at irregular intervals.

Length of an average specimen, five millimetres: breadth of the same at the aperture, nearly a millimetre and a half.

Hay River, forty miles above its mouth, R. G. McConnell, 1887, and Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: a few specimens on shells and corals.

These differ from specimens of *Ortonia intermedia* of Nicholson, from the Hamilton Formation of Ontario,* in the entire absence of the "strong encircling, sometimes lamellose annulations or ridges" which are said to characterize that species, but tubes almost, if not entirely devoid of annulations, are occasionally found in the Hamilton shales at Thedford and Arkona, Ont.

POLYZOA.

Hederella Canadensis, Nicholson.

Plate 28, figs. 8 and 8a.

Alecto (?) *Canadensis*, Nicholson. 1873. Canad Nat., vol. VII, 2nd Ser., p. 146.
Stomatopora (?) *alternata*, Hall and Whitfield. 1873. Twenty-third Reg. Rep. St. N. Y., p. 235, pl. x, figs. 7, 8.
Aulopora (?) *Canadensis*, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 124, figs. 57a–e.
Hederella Canadensis, Hall. 1881. Trans. Alb. Inst., vol. X, p. 194.
" " " 1885. Rep. St. Geol. for 1883, p. 53.
" " " 1887. Pal. St. N. Y., vol. VI, p. 277, pl. lxv, figs. 1-8, 14-16.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a few colonies attached to *Phillipsastræa Hennahi*, *Orthis striatula*, *Spirifera disjuncta* and *Atrypa reticularis*. Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: two specimens, attached to *Orthis striatula*.

* Rep. Palæont. Prov. Ontario, 1874, p. 122, figs. 55 a, b.

The size of specimens of the present species seems to be determined by that of the objects to which they are attached. When growing upon the surface of comparatively large corals the colonies attain to a length of two inches or more, but when attached to the shells of brachiopoda of medium size (such as *Orthis striatula* or *Atrypa reticularis*), upon which they have no room to expand, the maximum length of the colonies is usually less than an inch.

The genus *Hederella*, which, so far as known, is exclusively confined to rocks of Devonian age, was constituted by Professor James Hall in 1884 for the reception of a small group of cyclostomatous polyzoa of the type of *Aulopora Canadensis*, Nicholson. Of the five nominal species now referred to that genus, only two, viz., *H. Canadensis* and *H. filiformis*, have as yet been found in Canada.

In regard to the first of these it may be observed that, after a direct comparison of authentic examples of both, the present writer is convinced that *H. Canadensis* is both generically and specifically identical with the *Stomatopora alternata* of Hall and Whitfield, from the Devonian rocks of Iowa.

The second is a little creeping polyzoon which is abundant in the shales of the Hamilton formation at Thedford and Bartlett's Mills, near Arkona, Ont., and which was identified with the *Aulopora filiformis* of Billings by Professor H. A. Nicholson in 1874. Subsequently, in 1881, Professor Hall, who seems to have taken the correctness of this identification for granted, referred it to his then newly constituted genus *Hederella*, under the name *H. filiformis*. Unfortunately, however, the only description that Billings gave of his species is quite insufficient to enable it to be recognized, and it was not accompanied by any figure. The type and only known specimen of the *Aulopora filiformis* of Billings, which is still preserved in the Museum of the Survey and which is here figured for the first time (on Plate xxix., fig. 1), appears to the writer to be the immature state of a species of *Syringopora* allied to the *S. fascicularis* of Linnæus, from the Wenlock limestone of Dudley and elsewhere. It is so completely silicified that all traces of its internal structure are obliterated, but, although its corallites are at first creeping and form a large-meshed network, they ultimately become erect, though only for a short distance, and are more or less fasciculated. The *Aulopora filiformis* of Nicholson, on the other hand, is unquestionably a *Hederella*, as pointed out by Hall, and if sufficiently distinct from *H. Canadensis*, it will have to be called *H. filiformis*, Nicholson. But, when a large number of specimens of *Hederellæ* are carefully compared, they are found to vary so much in the amount of regularity of their mode of growth and

in the degree of slenderness of the colony, that it is often very difficult if not altogether impracticable, to distinguish between *H. Canadensis* and *H. filiformis*. Under these circumstances the writer is inclined to doubt whether the characters which have been relied upon to separate them are either permanent or of specific importance. According to Professor Nicholson, his *A. filiformis* is "a much more robust species" than *H. Canadensis*, "with larger tubes, and much more irregular methods of growth and apertures generally distinctly elevated above the general surface."

Proboscina laxa. (N. Sp.)

Plate 28, figs. 9, 9a.

Polyzoary creeping, adnate and attached by its whole under surface to some foreign body, spreading laxly and very irregularly branched, usually with numerous short branches proceeding from two or three widely divergent and procumbent tubular axes all of which are subcylindrical in transverse section, rather narrow and slightly swollen opposite the apertures of the cells. Cells entirely immersed, irregular in their disposition, but usually obscurely alternating biserial, the terminal ones subovate in outline: cell apertures not quite terminal, averaging a little less than one half the greatest breadth of the cells, subcircular in outline, with slightly elevated, simple and thin lips.

Surface smooth.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one perfect specimen, attached to *Orthis striatula*.

Stomatopora moniliformis. (N. Sp.)

Plate 28, fig. 10.

Polyzoary minute, creeping, attached by the whole of its under surface to some foreign object, very slender and fragile, consisting of a few irregularly disposed but more or less divergent rows of single cells, which, though uniserial, occasionally throw off lateral buds consisting of one or more cells, and which may, as in the specimen figured, proceed from a central or subcentral irregular aggregation of cells. Cells moderately convex, elliptical in marginal outline, averaging half a millimetre in length, about one third longer than broad and placed end

to end: apertures of the cells nearly terminal, extremely minute, simple and consisting of mere rounded perforations in the cell wall.

Surface smooth.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: four specimens each parasitic upon *Orthis striatula*.

This interesting little species is very closely allied to the *Hippothoa devonica* of Ehlert,* from the Devonian rocks of the Department of Mayenne, France, and perhaps should be referred to that genus rather than to *Stomatopora*. Its cell apertures are so minute that they can scarcely be seen with an ordinary simple lens, but their characters can be made out without much difficulty under an achromatic microscope with an inch and a half objective.

Ascodictyon stellatum, Nicholson.

Ascodictyon stellatum, Nicholson. 1877. Annals and Mag. Nat. Hist., 4th Ser., vol. XIX, p. 464.

East bank of the Clearwater River, about five miles below the Pembina, Professor Macoun, 1875: two or three specimens, attached to *Orthis striatula*. Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen on a worn fragment of shell. Athabasca River, thirty miles below the Red Deer River, and three miles below the Calumet, R. G. McConnell, 1890: five specimens from the first of these localities and four from the second, all attached to *O. striatula*.

The discovery and recognition of this diminutive little species at each of these localities is due to Mr. L. M. Lambe.

Paleschara quadrangularis, Nicholson. (Sp.)

Chætetes quadrangularis, Nicholson. 1874. Geol. Mag., N. Ser., Decade 2, vol. I, p. 58.

Chætetes quadrangularis, Nicholson. 1874. Rep. Palæont. Prov. Ontario, p. 61, fig. 18.

Paleschara quadrangularis, S. A. Miller. 1889. N. Amer. Geol. and Palæont., p. 177 (under *Chætetes*).

Hay River, forty miles above its mouth, R. G. McConnell, 1887: four specimens, one on *Orthis striatula*, one on *Spirifera disjuncta* and two on

* Bulletin de la Société d'Etudes Scientifiques d'Angers, année 1887.

Atrypa reticularis. Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one fine specimen, on *Atrypa reticularis*.

Monotrypella Unjiga.* (N. Sp.)

Plate 30, figs. 1, 1a-d.

Polyzoary erect, ramose: its terminal branchlets (which are all that happen to be preserved) slender, cylindrical and widely bifurcated, with rounded and slightly expanded apices: surface comparatively smooth, no monticules being developed. Cells polygonal, consisting of autopores only: cell walls thin internally, but much thickened at and near their apertures: transverse diaphragms thin, complete and placed at very irregular intervals.

Peace River, at Vermilion Falls, R. G. McConnell, 1889: a few fragments of the terminal branchlets, averaging ten to twelve millimetres in length and about two mm. in thickness.

Ceramopora Huronensis, Nicholson.

Ceramopora Huronensis, Nicholson. 1875. Rep. Palæont. Prov. Ont., p. 78, pl. ii, figs. 5, 5a.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a few specimens which are probably referable to this species. One is parasite upon *Orthis striatula*, and the others form four or five small isolated colonies upon a large specimen of *Alveolites vallorum*.

BRACHIOPODA.

Crania Hamiltoniæ, Hall.

Crania Hamiltoniæ, Hall. 1860. Thirteenth Reg. Rep. N. Y. St. Cab. Nat. Hist. p. 77.

Crania Hamiltoniæ, Hall. 1867. Pal. St. N. Y., vol. IV, pt. 1, p. 27, pl. iii., figs. 17-23.

Crania Hamiltoniæ, Nicholson. 1875. Rep. Palæont. Prov. Ont., p. 82.

Hay River, forty miles above its mouth, R. G. McConnell, 1887:

* The local Indian name for the Peace River.

three specimens, attached to the ventral valve of *Strophodonta demissa*. Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: one upper or dorsal valve.

Chonetes Logani, var. Aurora, Hall.

Plate 29, figs. 2, 2a.

Chonetes Logani, var. *Aurora*, Hall. 1867. Pal. St. N. Y., vol. IV, pt. 1, p. 137, pl. xxii, figs. 16-28.

Athabasca River, opposite La Saline, Professor Macoun, 1875, and R. G. McConnell, 1890,—also in the first ten miles below the Clearwater, about fifteen or twenty miles further up, Dr. R. Bell, 1882: a small piece of limestone, from each of these localities, strewn with detached valves of this species, the dorsal valves being better preserved than the ventral. Mackenzie River, at the "Ramparts," six large and unusually well preserved specimens of the ventral valve, one of which is figured, and three of the dorsal: also, on the same river, six miles below "Rock by the river side," a few partially exfoliated valves on a small piece of rock.

As the specimens from these localities appear to present some slight differences from the types of *C. Logani*, var. *Aurora* from New York and Ohio, the former may be characterized as follows:—

Shell rather small, concavo-convex or plano-convex, about one fourth broader than long, transversely semielliptical in marginal outline, cardinal border about equal to or a little less than the greatest breadth of the valves. Ventral valve moderately convex, its umbo broad and somewhat tumid, its beak small, depressed and incurved. On each side of the beak the cardinal edge is armed with three widely divaricating, long and slender spines. When viewed under a lens, the surface of the ventral valve is seen to be marked with numerous minute, but distinct and somewhat flexuous, rounded and radiating, thread-like raised lines which increase, by bifurcation and intercalation, from about fifty on the umbo to sixty near the front margin. These are crossed by slightly smaller and more close set, but in other respects similar, concentric raised lines (and occasionally also, by a few distant and comparatively coarse concentric wrinkles) in such a way as to produce a minutely nodulous network, though the radiating raised lines are more widely separated than the concentric ones, and the latter are sometimes interrupted, or in some cases dichotomous. Dorsal valve shallowly concave or nearly flat, its outer surface marked

by about eight or nine small concentric plications or imbricating lamellæ, with exceedingly minute and close set radiating striæ between them, and its inner surface minutely papillose. Cardinal tooth of the dorsal valve very small and bifid externally. Muscular and vascular impressions not preserved.

Dimensions of the most perfect specimens collected, (the ventral valve figured): length, seven millimetres and a half; breadth, ten mm.

Strophalosia productoides, Murchison.

Orthis productoides, Murchison. 1840. Bull. Soc. Géol. de France, vol. XI, p. 254, pl. ii, fig. 7.

Leptæna caperata, J. de C. Sby. 1840. Trans. Geol. Soc. Lond., 2nd Ser., vol. V, p. 704, pl. liii, fig. 4, plate liv, fig. 3.

Leptæna caperata, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somers., p. 58, pl. xxv, fig. 98.

Leptæna laxispina, Phillips. Ib., p. 59, pl. xxv, fig. 99.

Leptæna membranacea, Phillips. Ib., p. 60, pl. xxv, fig. 101.

Productus productoides, DeVerneuil. 1845. Russia and the Ural Mtns., vol. II, p. 283, pl. xviii, fig. 4.

Strophalosia productoides, Davidson. 1865. Brit. Dev. Brachiopoda, p. 97 (which see for a fuller list of synonyms that it has been thought necessary to quote here), pl. xix, figs. 13-21.

Strophalosia productoides, Whiteaves. 1889. This volume, p. 112 (under the heading "Productella (Strophalosia) truncata, Hall"), pl. xvi, figs. 1 and 2.

Athabasca River, first ten miles above the Clearwater, Dr. R. Bell, 1882, nine fine specimens, and opposite La Saline, about fifteen miles further down the river, R. G. McConnell, 1890, three specimens.

Productella dissimilis.

Productus dissimilis, Hall. 1858. Geol. Surv. Iowa, vol. I, pt. 2, p. 497, pl. iii, figs. 7a-e.

Productus dissimilis, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 91, pl. xiii, fig. 3. Not *Productus dissimilis*, DeKoninck, 1846.

Productus (*Productella*) *Hallanus*, Walcott. 1884. Pal. Eureka distr. Nev., p. 130, pl. xiii, figs. 17 and 17a.

Athabasca River,—between twenty and thirty miles below the Clear Water, Professor Macoun, 1875, (one specimen),—three miles below the Calumet (three specimens), and thirty miles below the Red River (one specimen), R. G. McConnell, 1890.

PRODUCTELLA SUBACULEATA, var. CATARACTA.

Productella subaculeata, var. *cataracta*, Hall and Whitfield. 1872. 24th Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 198, and (1875) 27th Reg. Rep. do., pl. ix, figs. 9 and 10.

Productella subaculeata, var. *cataracta*, Nettlewroth. 1889. Kentucky Geol. Surv., Kent. Foss. Shells, p. 69, pl. xvii, figs. 5-9.

Mackenzie River, at the "Rock by the river side," R. G. McConnell, 1888: four rather badly preserved but characteristic specimens.

PRODUCTELLA SPINULICOSTA, Hall.

Pl. 29, figs. 3, 3a, and pl. 31, fig. 1.

Productella spinulicosta, Hall. 1857. Tenth Reg. Rep. N. Y. St. Cab., p. 171.
" " " 1867. Pal. N. Y., vol. IV, p. 160, pl. xxiii, figs. 25-37.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: five well preserved and nearly perfect specimens, with some of the long and slender spines entire and in place.

Mackenzie River, at Grand View, forty-four miles below the "Ramparts," R. G. McConnell, 1888: four specimens, one of which is figured on Plate xxxi, in which nearly all the spines are preserved entire, on a small flat piece of argillaceous limestone. It is doubtful, however, whether these are sufficiently distinct from *P. subaculeata*, var. *cataracta*. Professor Hall expressly states that he is "not entirely satisfied" that *P. spinulicosta* is specifically different from his *P. Shumardiana*, and this latter shell is regarded by Mr. Walcott as probably identical with *P. subaculeata*.

PRODUCTELLA LACHRYMOSA, var. LIMA.

Strophomena lima, Conrad. 1842. Journ. Ac. Nat. Sc., Phil., vol. VIII, p. 256.
Productella lachrymosa, var. *lima*, Hall. 1867. Pal. N. Y., vol. IV, p. 174, pl. xxv, figs. 29-32.
Productus (*Productella*) *lachrymosus*, var. *limus*, Walcott. 1884. Pal. Eureka distr. Nevada, p. 132, pl. xiii, figs. 18 and 18a.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: a few rather badly preserved specimens, which are essentially similar to two from the Eureka district of Nevada labelled *P. lachrymosa* var. *lima*, by Mr. C. D. Walcott, and kindly forwarded by him for comparison.

Although here referred provisionally to four nominal species, it is most probable that the three last enumerated, if not the whole four, are nothing more than mere local varieties of *P. subaculeata*.

ORTHIS STRIATULA, Schlotheim.

Orthis striatula (Schlotheim). Davidson. 1865. Mon. Brit. Dev. Brach., p. 87, (which see for a full list of the synonyms of this species) pl. xvii, figs. 4-7. Comp. especially with Schnur's figures of *O. striatula* from the Eifel.

Orthis Iowensis, Billings. 1859. In Hind's Rep. Expl. Assinib., Saskatch., &c., p. 187, woodcut, fig. 1a.

" " Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 90, pl. xii, figs. 2 a-h.

Abundant on the east bank of the Clearwater River, five miles below the Pembina, where it was collected by Professor Macoun in 1875 and by Mr. A. S. Cochrane in 1881. Hay River, forty miles above its mouth, R. G. McConnell, 1887: a number of fine specimens. Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: four specimens. Athabasca River, three miles below the Calumet and thirty miles below Red River, R. G. McConnell, 1890: apparently common at each of these localities. In Manitoba the same species is said to have been collected at Snake Island, Lake Winnipegosis, by Professor H. Y. Hind, and several fine examples of it were obtained by Prof. Macoun in 1881 on the north shore of the Red Deer River, about half way between Red Deer Lake and Lake Winnipegosis.

Adult specimens of this shell from the Hay River and the "Ramparts" are in some respects intermediate in their characters between the large, broad and compressed form of *O. striatula*, from the Clearwater which Meek described and figured as *O. Iowensis*, and *O. McFarlanei*. They resemble the latter species in the great convexity of their dorsal valves and in the deep marginal sinus of the ventral, but are never so narrowly elongated immediately behind the midlength. Other specimens, again, from the Mackenzie River district, are strikingly similar to the large variety of *O. Tulliensis* of Hall, as figured by Prof. H. S. Williams on Plate 12, fig. 3, of his paper on the "Cuboides Zone and its Fauna."*

In the "American Geologist" for April, 1889, Prof. Williams says that *Orthis Iowensis* is but a western variety of the *O. impressa* of the New York faunas, both of which are but varieties of the European *O. striatula* of Schlotheim, and it is most probable that *O. McFarlanei* is only another local variety of the same species.

* Bulletin Geol. Soc. America, May, 1890.

The specimens from the Clearwater and other Canadian localities which have been referred to *O. Iowensis* appear to the writer to be practically indistinguishable from *O. striatula*, even as a local variety. At any rate they seem to correspond much better with Schnur's figures of specimens of *O. striatula* from the Eifel, and with Davidson's illustrations of British examples of the same species, than they do with Hall's figures of the types of *O. Iowensis* and its variety *furnarius*.

It is probably this species that was collected by Sir John Richardson in 1825 on the Slave River, forty miles below Lake Athabasca and referred to, on the authority of Mr. J. DeCarle Sowerby,* as a *terebratula* which resembles the *T. resupinata*. Judging by what is known of the geology of this region the shell last named could scarcely be the Liassic fossil now known as *Waldheimia resupinata* but by no means improbably the *Orthis resupinata* (Martin, sp.) of the Carboniferous, the *Terebratula resupinata* of Plate 325 of the "Mineral Conchology," which is regarded by many palæontologists as a variety of *O. striatula*.

STROPHODONTA DEMISSA (Conrad).

Strophomena demissa, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, pt. 2, p. 238, pl. xiv, fig. 14.
Strophomena (Strophodonta) demissa, Hall. 1857. Tenth Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 137.
Strophodonta demissa, Hall. 1858. Geol. Iowa, vol. I., pt. 2, p. 495, pl. iii, fig. 5.
Strophomena demissa, Billings. 1861. Canad. Journ., N. S., vol. VI, p. 341, figs. 116-118.
Strophomena demissa, Billings. 1863. Geol. Canada, p. 367, figs. 377 a-d.
Strophodonta demissa, Hall. 1867. Pal. N. Y., vol. IV, pp. 81, 101 and 114, pls. xi, xii, xvii and xix.
Strophomena (Strophodonta) demissa, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 87, pl. xiii, figs. 6 a-c.
Strophodonta demissa, Nicholson. 1873. Rep. Palæont. Prov. Ontario, p. 65.
" " Whitfield. 1883. Geol. Wisconsin, vol. IV, p. 327, pl. xxv, fig. 18.
" " Walcott. 1884. Palæont. Eureka distr. Nevada, p. 118, pl. ii, figs. 9 a-b.

Peace River, at Rapid Bouillé, Professor Macoun, 1875: one perfect specimen. Hay River, forty miles above its mouth, R. G. McConnell, 1887: eleven specimens. Peace River, at Vermilion Falls, R. G. McConnell, 1889: three specimens. Athabasca River, three miles below the Calumet, (eight specimens) and thirty miles below the Red River (six specimens), R. G. McConnell, 1890.

* On page 57 of Appendix No. 1 to Sir John Franklin's "Narrative of a Second Expedition to the shores of the Polar Sea.

STROPHODONTA PERPLANA, Conrad.

Strophomena perplana, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, p. 257, pl. xiv, fig. 11.

Strophomena pluristriata, Conrad. Ib., p. 259.

Strophomena delthyris, Conrad. Ib., p. 258, pl. xiv, fig. 19.

Strophomena crenistria, Hall. 1843. Rep. Fourth Geol. distr. N. Y., p. 171.

" *nervosa*, Hall, Ib., p. 266, fig. 1.

Strophodonta fragilis, Hall. 1857. Fourth Reg. Rep. N. Y. State Cab. Nat. Hist., p. 143.

Strophodonta fragilis, Hall. 1858. Geol. Iowa, vol. I, pt. 2, p. 496, pl. iii, figs. 6 a-c.

Strophomena perplana, Billings. 1861. Can ad. Journ., N. S., vol. VI, p. 343.

Strophodonta perplana, Hall. 1867. Pal. N. Y., vol. IV, pp. 92, 98 and 113, pls. xi, xiii, xvii. and xix.

Strophomena perplana, Nicholson. 1873. Pal. Ontario, p. 64, figs. 20a, a.

Strophodonta perplana, Walcott. 1884. Pal. Eureka distr. Nevada, p. 120, pl. xiii, figs. 11.

Strophodonta perplana, var. *Tulliensis*, (?) H. S. Williams. Bull. Geol. Soc. Am., May, 1890, p. 493, pl. xii, figs. 1-4.

Peace River, at Vermilion Falls, R. G. McConnell, 1889: a nearly perfect and well preserved ventral valve, which resembles *S. perplana*, var. *Tulliensis*, in the circumstance that each end of its hinge line is produced into a short spine or mucronate point. It is, however, much larger than the figured type of that variety, and the mucronate points at its cardinal angles are proportionately shorter and not so slender.

Prof. Williams (op. cit., p. 493) says that *S. perplana* "appears to be an American type, and is seen with variations all through our Devonian, but it is not described in the American Devonian." "In the European race" (of the *Strophodonta inæquistriata* type) "as we reach the Cuboides Zone, the terminations of the hinge develop into slender mucronate points." "In the American race" (*S. perplana*) "these mucronate points first appear in the Tully limestone, and are characteristic of the race afterward till it ceases." Mucronate lateral extensions of the hinge line, however, occur in the *Strophomena Leda* of Billings,* from the Silurian rocks at Anticosti, and in an undescribed species of *Strophomena* recently collected by Mr. J. B. Tyrrell from rocks of about the same age on the east side of Lake Winnipegosis, at Cedar Lake and on the Saskatchewan, they are developed into exceedingly long and slender spines.

* Geol. Surv. Canada. Palæozoic Fossils, vol. I., p. 120, figs. 98, 99.

SPIRIFERA DISJUNCTA, Sowerby.

Plate 29, fig. 4.

Spirifera disjuncta, Sowerby. 1840. Trans. Geol. Soc. Lond., 2nd Ser., vol. V, pl. liii, fig. 8, and pl. liv., figs. 12-13.
" *calcarata*, Sowerby. Ibid., pl. liii, fig. 7.
" *extensa*, Sowerby. Ibid., pl. liv, fig. 11.
" *gigantea*, Sowerby. Ibid., pl. lv, figs. 1-4.
" *inornata*, Sowerby. Ibid., pl. liii, fig. 9.
Spirifera Verneuilii, Murchison. 1840. Bull. Soc. Géol. France, vol. XI, p. 252, pl. ii, fig. 3.
Spirifera disjuncta, Davidson. 1865. Mon. Brit. Dev. Brach., pp. 23 and 24 (which see for a complete list of synonyms of British and European specimens of this series), pl. v, figs. 1-12 and pl. vi, figs. 1-5.
Spirifera disjuncta, Hall. 1867. Pal. N. Y., vol. IV, pls. xli, and xlii, and Walcott, 1884, Pal. Eureka distr. Nevada, p. 134 [which see for list of synonyms of N. American specimens).
Spirifera Kennicotti, Meek. 1860. Trans. Chicago Ac. Sc., vol. I, p. 101, pl. xiv, fig. 9.

Peace River, at Fossil Point, A. R. C. Selwyn, 1875: a few badly preserved specimens.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: abundant and in fine condition. Peace River, at Vermilion Falls, R. G. McConnell, 1889: six specimens.

At these localities, and especially at the latter two, most of the specimens collected belong to the typical form of the species, or at any rate to that which Davidson regarded as such and illustrated under that name on Plate v. of his "Monograph of the British Devonian Brachiopoda." In this form, no matter what the marginal outline of the shell may be, the umbo and beak of the ventral valve are appressed and incurved, while its area, which is concavely arched and nearly vertical, is very narrow in the direction of its height.

As will be seen upon reference to the synonymy quoted, this very variable species was described in 1840 by no less than six different specific names, and it is still doubtful which of these should be retained. Although here called *Spirifera disjuncta*, Sowerby, on account of the very general usage to that effect, especially in American publications, it would seem that the proper name of the species is *S. Verneuilii*, Murchison. In Davidson's monograph (op. cit.), although the species is at first called *S. disjuncta* in the text, yet, in a foot note to page 100, the following very explicit statement is made:—"From having unfor-

tunately overlooked the fact of Murchison's paper in the "Bulletin" having been read twenty three or twenty four days sooner than that of Sowerby, published in the Transactions of the Geological Society, I adopted at page 23 of this Monograph the term *Spirifer disjunctus*, Sow., while that of *S. Verneuilii* has a claim to priority." The Sandbergers, however, (Die Versteinerungen des Rheinischen Schichtensystems in Nassau, p. 320) adopt *Spirifer calcaratus*, J. Sowerby, as the oldest name for this species.

Characteristic specimens of *Spirifera Whitneyi*, Hall (which Professors Hall and Whitfield place as a synonym of the present species, on page 237 of the Twenty-third Reg. Rep. N. Y. Stat. Cab. Nat. Hist., under the heading of *S. Orestes*), were collected by Mr. McConnell in 1885, from limestones apparently of Devonian or Devono-Carboniferous age, in the easternmost range of the Rocky Mountains on the North Saskatchewan.

Spirifera disjuncta, var. occidentalis. (N. Var.)

Plate 29, figs. 5 and 5a.

This new varietal name is here proposed for a remarkable local form of *S. disjuncta* (or *S. Verneuilii*), in which the umbonal region and beak of the ventral valve are strongly divergent from those of the dorsal. The beak of the ventral, too, is erect rather than recurved, while its area is broad (in the direction of its height) and flattened almost horizontally.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: four specimens.

Spirifera cyrtinæformis, Hall and Whitfield.

Spirifera cyrtinæformis, Hall and Whitfield. 1870. Twenty-third Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 238, pl. ii, figs. 21-24.

(?) *Spirifer aperturatus*, Schlotheim, var. *cuspidatus*, D'Archiac and DeVerneuil. 1841. Trans. Geol. Soc. Lond., 2nd Series, vol. VI, p. 369, pl. xxxv, figs. 7 and 7a.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one perfect specimen in a fine state of preservation. This has been compared with authentic examples of S. *cyrtinæformis* from the "marly beds" at Rockford, Iowa, recently received from Professor S. Calvin, and has been found to differ therefrom only in the much larger size and consequently smaller number of its radiating ribs or plications. In

the original description of *S. cyrtinæformis* the surface of the valves is said to be "marked by about forty five to fifty low, rounded plications, whereas in the specimen from the Hay River there are only twenty nine or thirty. This difference, however, can scarcely be regarded as of specific importance.

S. cyrtinæformis is very closely allied to the *S. Utahensis* of Meek,* which Mr. Walcott places among the synonyms of *S. disjuncta*. On the other hand, *S. cyrtinæformis* appears to the writer to be specifically identical with the fossil from the Eifel which D'Archiac and DeVerneuil described and figured under the name *S. aperturatus*, var. *cuspidatus*. In his Monograph of the British Devonian Brachiopoda (page 26) Davidson says that *S. aperturatus* is a synonym of *S. canalifera*, Valenciennes (in Lamarck's Hist. Nat. des Animaux sans Vertèbres), but makes no reference to D'Archiac and DeVerneuil's description and figures of *S. aperturatus* and its var. *cuspidatus*. He farther states (op. cit., p. 26) that "*Sp. canalifera* has much of the general shape of *S. disjuncta*, but will be easily distinguished on account of the bifurcation of its lateral ribs, a feature not observable in *S. disjuncta*." According to Prof. Hall, in *S. cyrtinæformis* "the central plication on the mesial fold and sinus divides once or twice before reaching the front of the shell; the other plications are simple."

Spirifera subattenuata, Hall.

Spirifera indet. Owen. 1852. Rep. Geol. Surv. Wiscons., Iowa and Minnes., pl. iii, fig. 9.

Spirifer submucronatus, Hall. 1858. Geol. Rep. Iowa, vol. I., pt. 2, p. 504 (but as this name was found to be preoccupied it was changed to *S. subattenuata* on p. 3 of the index), pl. iv, figs. 3a, b, c.

Athabasca River,—opposite La Saline, Dr. R. Bell, 1882, a few small specimens,—three miles below the Calumet River, R. G. McConnell, 1890, three specimens,—and thirty miles below Red River, R. G. McConnell, 1890, two specimens.

Spirifera inutilis, Hall.

Spirifer inutilis, Hall. 1858. Geol. Rep. Iowa, vol. I, pt. 2, p. 505, pl. iv, figs. 4a, b, c.

Localities, collectors and dates the same as for the preceding species:

* See Col. Simpson's Rep. Expl. acr. Great Basin of Utah, 1876, p. 345, pl. i, figs. 4, a. b, c, and U. S. Geol. Expl. Fortieth Parallel, vol. IV, 1877, p. 39, pl. iii., figs. 1. 1a-c.

also Pembina River, four miles above its mouth, R. G. McConnell, 1890.

S. inutilis would seem to be nothing more than a mere variety of *S. subattenuata*, in which the hinge area of the ventral valve is proportionately larger and higher, and the cardinal extremities of both valves not nearly so much produced.

Spirifera tullia, Hall. Var.

Plate 32, figs. 1, 1a, b.

Spirifera tullia, Hall. 1867. Pal. St. N. Y., vol. IV, p. 218, pl. xxxv, figs. 1-9.

Shell small, transversely subelliptical or semielliptical, a little broader than long and broadest just behind the midlength: cardinal angles more or less rounded, lateral margins rounding regularly into the front, which is shallowly concave at the termination of the mesial fold and sinus. Ventral valve much more convex than the dorsal, most prominent in the umbonal region, with the sides curving regularly to the margin, but depressed in the centre, its mesial sinus well defined, rounded, very narrow on the beak and umbo, but widening rather rapidly toward the front, where its width slightly exceeds one third of the greatest breadth of the valve: beak small, not very prominent, its apex only being slightly incurved, but not so much so as to cover or overarch any part of the fissure: area moderately high and slightly concave: fissure triangular, higher than wide, with an impressed line or narrow linear groove on each side. Dorsal valve very gently convex, its mesial fold rounded and not much elevated, sometimes with a faint narrow depression in the centre, its hinge line nearly straight and its beak minute and projecting very little above the cardinal margin.

On each side of the mesial fold and sinus there are from seven to nine rounded but somewhat flattened and simple radiating ribs or plications, but there are none on the fold or sinus. In addition to the ribs, the whole surface when examined under a lens is seen to be marked with exceedingly numerous, close-set and minute, but continuous, radiating raised lines, which are crossed by equally minute and nearly as densely crowded concentric raised lines, in such a way as to produce an exquisitely fine network, which is subgranulose at the points of intersection. The radiating raised lines are not always exactly parallel to the ribs, and the concentric ones are regularly arched where they cross over the ribs, fold or sinus.

Dimensions of the specimen figured: length, as measured in the centre, thirteen millimetres and a half; maximum breadth, fifteen mm.; greatest height or depth of the closed valves, nine mm.; width of mesial sinus at the front margin, six mm.

Athabasca River,—first ten miles below the mouth of the Clear Water, Dr. R. Bell, 1882,—and opposite La Saline, twenty-five miles below the mouth of the Clear Water, R. G. McConnell, 1890: one perfect and well preserved specimen from each of these localities.

These seem to represent a mere local variety of *S. tullia*, in which the beak of the ventral valve is much less arched and hooked than it is in the typical form, and the number of ribs or plications on each side of the mesial fold and sinus is much smaller. Prof. H. S. Williams, who has kindly compared both of the specimens from the Athabasca with authentic samples of *S. tullia*, says that, in addition to these differences, the area of the ventral valve in the former is proportionately flatter and higher, and the finer surface striæ are decidedly coarser than in *S. tullia*.

Subgenus Martinia, McCoy.

Spirifera (M.) glabra, var. Franklini.

Spirifer (*Martinia*) *Franklini*, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 107, pl. xiv, figs, 12a-c. For a list of the synonyms of *S glabra*, Martin, see Davidson's Mon. Brit. Carbon. Brach., p. 62.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one rather small but nearly perfect specimen. Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one large and perfect specimen and a detached ventral valve of another.

The specific identity of the *S. Franklini*, Meek, with the *S. glabra* of Martin (the type of McCoy's subgenus *Martinia*) was first suggested by Mr. C. D. Walcott in 1884, in his "Palæontology of the Eureka district of Nevada." On page 139 of that monograph, under the heading *Sp.* (*M.*) *glabra*, Mr. Walcott makes the following remark:—"*Spirifera* (*M.*) *Franklini*, Meek," * * * "is, as mentioned by Mr. Meek, closely related to *S.* (*M.*) *glabra*, and with the original specimen before me to compare with the Nevada shells and Mr. Davidson's figures of the species, it scarcely appears to be more than a variety, if even that, of *S.* (*M.*) *glabra*."

SPIRIFERA (M.) MERISTOIDES, Meek.

Spirifer (*Martinia*) *meristoides*, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 106, pl. xiv, figs. 3 a-h.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: twenty-six specimens, most of which are perfect or nearly perfect and in good condition.

On page 142 of the "Palæontology of the Eureka District," Mr. Walcott expresses the opinion that the *S.* (*M.*) *meristoides*, as described and figured by Meek, is identical with the *Athyris Maia* of Billings and the *Spirifera Maia* of Hall. The specimens from the "Ramparts," however, most of which have the appearance of adult shells, are uniformly smaller than the typical *A.* (or *S.*) *Maia*, and show no trace of a mesial fold in the dorsal valve or of a corresponding sinus in the ventral, both of which features are marked characters in full grown examples of Mr. Billings' species.

SPIRIFERA (M.) RICHARDSONI, Meek.

Spirifer (*Martinia*) *Richardsoni*, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 104, pl. xiv, fig. 2.

Athabasca River, opposite La Saline, Dr. R. Bell, 1882: one small specimen, about half the size of the one figured by Meek, but perfect and with the whole of the test preserved. In this specimen, which is obviously immature, the mesial fold and sinus are not developed. Its surface appears to be smooth to the naked eye, but when examined under the lens it is seen to be marked with a few more or less distant concentric striæ, or lines of growth, and with twelve or thirteen faint, rounded and radiating plications. Mr. Walcott (op. cit., pp. 143 and 144) is inclined to think that *S.* (*M.*) *Richardsoni* is one of the forms of *S. undifera*, Roemer.

CYRTINA HAMILTONENSIS, Hall.

Cyrtia Hamiltonensis, Hall. 1857. Tenth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 166.

Cyrtia Hamiltonensis, Billings. 1861. Canad. Journ., N. Ser., vol. VI, p. 262, figs. 80-82.

Cyrtia Hamiltonensis, Billings. 1863. Geol. Canada, p. 384, figs. 415a-c.

Cyrtina Hamiltonensis, Hall. 1867. Pal. N. Y., vol. IV, p. 268, pl. xxvii, figs. 1-4, and pl. xliv, figs. 26-33, 38-52.
Cyrtina Hamiltonensis, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 99, pl. xiv, figs. 5, 7 and 10.
Cyrtina Hamiltonensis, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 83.
" " Walcott. 1884. Pal. Eureka distr. Nevada, p. 147.

Mackenzie River, at the "Ramparts" (two specimens), and ten miles below the "Ramparts" (one specimen), R. G. McConnell, 1888. The species had previously been collected at the "Ramparts," in 1859, by Major Kennicott, and near Fort Good Hope, five miles below the "Ramparts," in 1884, by Mons. l'Abbé Petitot.

Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: a few perfect and well preserved specimens.

Cyrtina Billingsi, Meek.

Cyrtina Billingsi, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 97, pl. xiv, fig. 6.

Athabasca River, thirty miles below Red River, R. G. McConnell, 1890: one fine and perfect large specimen, and a similar but much smaller one.

Athyris Angelica, var. occidentalis.

Plate 32, figs. 3, 3a, b.

Athyris Angelica, Hall. 1861. Fourteenth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 99.
Athyris Angelica, Hall. 1867. Pal. N. Y., vol. IV, p. 292, pl. xlvii, figs. 9-20.

Shell like the type of *A. Angelica*, but much smaller and more distinctly biplicated. Ventral valve with two widely divergent rounded and prominent plications, which extend to the beak, with a shallow sinus between them. Dorsal valve with a broad flattened mesial fold and a narrow divergent one on each side. The surface markings seem to consist of concentric striations only, no trace of any radiating lines being visible even under a lens. In average examples the greatest breadth is about half an inch and the maximum length a little less. The largest specimen collected, a detached ventral valve, is 15.5 mm. (or about five eighths of an inch) in its greatest breadth and 13.5 mm.

in length. The specimens of *O. Angelica* figured by Professor Hall are from a little less than three quarters to fully one inch in breadth.

Athabasca River, first ten miles below the Clear Water, and opposite La Saline, about fifteen miles farther down the river, Dr. R. Bell, 1882: four good specimens from the first of these localities and seven from the second.

Athyris parvula. (N. Sp.)

Plate 32, figs. 4, 5 and 5a.

Shell very small for the genus, moderately convex, varying in lateral outline from transversely subelliptical to subcircular or longitudinally and broadly subovate, in some specimens a little broader than long, in others the reverse: anterior margin distinctly sinuated. Ventral valve more convex than the dorsal, its front margin depressed in the centre in such a way as to form a regularly concave mesial sinus which becomes obsolete at or near the midlength, its umbo prominent, tumid and rather broad, and its incurved beak truncated almost vertically and perforated with a circular foramen. Dorsal valve with a moderately elevated, rounded mesial fold on and near the front margin, its beak being small, narrow and not very prominent.

Surface marked with regularly disposed, nearly equidistant and somewhat imbricating, concentric striations. Characters of the interior of the valve unknown.

The largest specimen collected, a detached ventral valve, is nine millimetres and a half in length, and ten mm. in its greatest breadth. The dimensions of two other perfect specimens are as follows:—No. 1, (fig. 4) maximum length, nine mm.; greatest breadth, nine mm. and a half (9.5); maximum thickness, six mm.; No. 2, (figs. 5 and 5a) length, eight mm. and a quarter (8.25); breadth, eight mm.; thickness, five mm. and a half (5.5.)

Athabasca River, three miles below the Calumet (five good specimens) and thirty miles below Red River (one perfect specimen), R. G. McConnell, 1890.

This diminutive little species seems to be more nearly related to the *Athyris vittata* of Hall than to the *S. spiriferoides* of Eaton, though it may prove to be only a local diminutive race of the latter. As compared with a series of authentic examples of *A. vittata*, from two localities in Iowa, recently forwarded by Prof. S. Calvin, the specimens collected by Mr. McConnell differ therefrom, not only in their much smal-

ler size, but also in the fact that their front margins are much more distinctly sinuated. From Ohio specimens of *A. vittata*, such as those described and figured by Prof. Hall, the specimens from the Athabasca differ also in their much smaller size and in the circumstance that the mesial fold and sinus of each are more rounded and do not extend nearly as far backward.

Atrypa reticularis, L.

For a complete list of synonyms of this species see Davidson's "Monograph of the British Devonian Brachiopod[illegible]ge 53, the same authors "British Silurian Brachiopoda," p. [illegible]9, or Hall's Paleontology of the State of New York, vol. [illegible], pt. 1, p. 316.

Peace River, at Vermilion Falls, R. G. McConnell, 1889. Athabasca River, from the mouth of the Clear Water to about twenty five miles below that stream, and thirty miles below Red River; A. S. Cochrane, 1881, Dr. R. Bell, 1882, and R. G. McConnell, 1890. East side of Clear Water River, five miles below the Pembina, Prof. Macoun, 1875. Hay River, forty miles above its mouth, R. G. McConnell, 1887. Mackenzie River, at the "Ramparts," and at Grand View, forty four miles below the "Ramparts," R. G. McConnell, 1888. Apparently abundant at each of these localities. The species had previously been collected by Messrs. Kennicott and Macfarlane on the Mackenzie River at the "Ramparts" and near Fort Good Hope.

Atrypa reticularis, var. aspera.

Terebratula aspera, Schlotheim. 1820. Petrefact., p. 263, t. xviii, fig. 3.
Atrypa aspera, Dalman. 1827. Vet. Akad. Handl., t. iv, fig. 3.
Atrypa reticularis, var. *aspera*, Davidson. 1864. Brit. Dev. Brach., p. 57 (which see for a full list of synonyms of this shell), pl. x, figs. 5-8.
Atrypa aspera, var. *occidentalis*, Hall. 1858. Geol. Iowa, vol. I, pt. 2, p. 515, pl. vi, figs. 3a, b, c, d.
Atrypa spinosa, Hall. 1843. Geol. Rep. Fourth Distr. N. Y., p. 200, figs. 1 and 2.
Atrypa dumosa, Hall. Ibid., p. 271, fig. 1.
Atrypa spinosa, vel. *A. aspera*, Hall. 1867. Pal. N. Y., vol. IV, pt. 1, p. 322, pl. liii.A, figs. 1-14, 18, 24 and 25.
Atrypa aspera, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 96, pl. xiii, fig. 12.

Peace River, at Vermilion Falls, R. G. McConnell, 1889. Athabasca

River, first ten miles below the Clear Water, Dr. R. Bell, 1882; three miles below the Calumet and thirty miles below Red River, R. G. McConnell, 1890. Pembina River, four miles above its mouth, R. G. McConnell, 1890. Hay River, forty miles above its mouth, R. G. McConnell, 1887. Mackenzie River, at the "Ramparts," and ten miles below the "Ramparts," R. G. McConnell, 1888; apparently as common as the typical form at each of these localities. The occurrence of this shell at the Ramparts and Fort Good Hope had previously been recorded by Meek, and an unusually large and fine specimen of it, which is now in the Survey collection, was collected by l'Abbé Petitot in 1874 near Fort Good Hope.

In the typical *A. reticularis* the radiating ribs are very fine and numerous, so much so that in a large and well preserved specimen of it from the Hay River, as many as 180 of them can be counted on the front margin of the shell. According to Professor Hall, in the Iowa shells for which he proposed the name *A. aspera*, var. *occidentalis*, the surface is "marked by ten or twelve dichotomizing plications upon each valve," so that there would not be much more than twice those numbers on their front margins. Professor Hall, however, states that in this western variety "the number of plications is only about half as many as in full grown specimens of the species in the shales of the Hamilton group of New York."

The reasons which induced Dr. Davidson to concur with Hisinger, Lindström, Brown and McCoy in regarding the *A. aspera* of Schlotheim as a mere variety of *A. reticularis*, are fully stated on page 57 of the "British Devonian Brachiopoda." The numerous and perfect specimens collected by Mr. McConnell on the Peace, Hay and Mackenzie Rivers would seem to support this conclusion, as most of them are intermediate in their characters between *A. reticularis* proper and *A. aspera*. The greater number of them, too, correspond much better with Hall's descriptions and figures of the eastern shell which he has called *A. spinosa* than with the western form of *A. aspera*, and in several specimens from the Hay River the comparatively fine radiating ribs are distinctly spinose.

Rhynchonella pugnus, Martin.

Conchyliolithus anomites pugnus, Martin. 1809. Petref. Derb., tab. xxii, figs. 4, 5.
Atrypa pugnus, Sowerby. 1840. Geol. Trans., 2nd Ser., vol. v, pl. lvi, figs. 15-18.
Terebratula pugnus, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somers., p. 87, pl. xxxv, figs. 156 a-e.
Terebratula anisodonta, Phillips. 1841. Ib., p. 86, pl. xxxiv, figs. 154 a-c.

Rhynchonella pugnus, Davidson. 1861. Mon. Brit. Carb. Brach., p. 47, pl. xxii, figs. 1-15. Ib. Mon. Brit. Dev. Brach., 1865, p. 63, pl. xii, figs. 12-14, pl. xiii, figs. 8-10.

Rhynchonella Missouriensis, Meek. 1866. Geol. Surv. Illinois, vol. II, p. 153, pl. xiv, figs. 4a, b. Fig. 5a of pl. C, 2nd Ann. Rep. Geol. Surv. Missouri, 1855, is also referable to *R. pugnus*, as stated by Mr. Meek. Not *R. Missouriensis*, Meek, 1868, ib., vol. III, p. 450, pl. xiv, figs. 7a-d.

Rhynchonella alta, Calvin. 1877. Paper read before the Iowa Ac. Sc. and a named photographed plate distributed.

Rhynchonella pugnus, Williams. 1883. Am. Journ. Sc., vol. XXV, p. 99.

" " Walcott. 1884. Pal. Eurek. Distr. Nev., p. 155 (from which this list of synonyms is quoted), pl. xiv, figs. 7, 7a.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one perfect specimen. Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: two small specimens.

The small *Rhynchonella* referred to on page No. 100 of the Report of Progress of the Geological Survey of Canada for 1875-76 as having been collected by Dr. Selwyn in 1875 at Fossil Point on the Peace River, is probably a variety of *R. pugnus*.

Rhynchonella cuboides, Sowerby.

Atrypa cuboides, Sowerby. 1840. Trans. Geol. Soc., Ser. 2, vol. V, pl. vi, fig. 24.

" *crenulata*, Sowerby. 1840. Ibid., fig. 17.

" *impleta*, Sowerby. 1840. Ibid., pl. lvii, fig. 2.

Terebratula cuboides, DeKoninck. Anim. foss. de Belgique, p. 285, tab. 19, fig. 3.

" " Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somers., p. 84, pl. xxxiv, fig. 150.

Terebratula crenulata, Phillips. 1841. Ibid., p. 85, pl. xxxiv, fig. 152.

Atrypa cuboides, Vanuxem. 1842. Geol. Rep. Third Distr. N. Y., p. 163, fig. 1.

" " Hall. 1843. Geol. Rep. Fourth Distr. N. Y., pp. 215 and 216, fig. 1.

Rhynchonella venustula, Hall. 1857. Pal. N. Y., vol. IV, p. 346, pl. liv.A, figs. 24-43.

Rhynchonella Emmonsi, Hall and Whitfield. 1877. Geol. Expl. 40th Par., vol. IV, p. 247, pl. iii, figs. 4-8.

Rhynchonella intermedia, Barris. 1878. Proc. Davenport Ac. Nat. Sc., vol. II, p. 285, pl. xi, figs. 5-6.

Rhynchonella Emmonsi, Walcott. 1884. Pal. Eureka Distr. Nev., p. 157.

Rhynchonella cuboides and *R. venustula*, H. S. Williams. 1890. Bullet. Geol. Soc. America, p. 493, pl. xiii.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one perfect but not very well preserved specimen. Peace River, at Ver-

milion Falls, R. G. McConnell, 1889: two perfect but partially exfoliated specimens. The one from the Hay River has eleven rounded and undivided ribs on the mesial sinus, at the front margin, ten similar ones on the fold, and fourteen or fifteen flattened ribs on each side. In the larger of the two specimens from the Peace River there are eleven flat ribs on the sinus, ten rounded ones on the central fold, and eighteen to twenty on each side.

The rather coarsely ribbed variety of the species from the State of New York to which Hall subsequently gave the name *Rhynchonella venustula*, was originally identified by Conrad and Vanuxem with the *Atrypa cuboides* of Sowerby. Under the heading of *Rhynchonella Emmonsi*, also, Mr. C. D. Walcott remarks:—"There is very little doubt but that *R. intermedia*, *R. Emmonsi* and *R. venustula* are varieties of *R. cuboides*." The three specimens collected by Mr. McConnell are doubtless conspecific with the Nevada shell which has been called *R. Emmonsi*, but they also appear to the writer to be quite indistinguishable from the *R. venustula* as figured by Prof. Williams (op. cit., pl. xiii, figs. 4 and 8), from some of the specimens of *R. cuboides* figured by the same author, and from the coarsely ribbed forms of *R. cuboides* (var. *impleta*), illustrated by Davidson on plate xiii, figs. 20 and 21, of his Monograph of British Devonian Brachiopoda. Prof. Williams (op. cit., pp. 493-94) says that "*R. venustula*, Hall, is by common consent closely allied to *R. cuboides* of Europe, the chief distinction lying in the number of plications in the median fold and sinus which are less than in the prevailing type of the European *cuboides*." Yet, in one of the specimens of *R. venustula* figured by Professor Hall (op. cit. fig. 43) there are as many as ten radiating ribs in the mesial sinus of the ventral valve.

Rhynchonella castanea, Meek.

Rhynchonella castanea, Meek. 1868. Trans. Chicago Ac., Sc., vol. I, p. 93, pl. xiii, figs. 9 a-c.

Rhynchonella castanea, Walcott. 1884. Pal. Eureka Distr. Nev., p. 153, pl. xv, figs. 1, 1a, 4 and 4a.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one perfect specimen.

EATONIA VARIABILIS. (N. Sp.)

Plate 29, figs. 6, 6a, 7, 8, 8a and 9.

Shell compressed biconvex, the thickness through the closed valves varying in different specimens from a little more to a little less than one half of their greatest breadth, transversely subelliptical, a little broader than long: front margin truncated in the centre in some specimens (as in fig. 6), regularly rounded in others (as in fig. 7), and in some (as in fig. 8), produced into a short rounded lobe. Ventral valve moderately convex on the umbo, immediately below or in front of which there is a more or less well defined mesial sinus, which widens rapidly forward and outward. Beak of the ventral valve small, projecting very little beyond that of the dorsal, slightly incurved, truncated and perforated by a minute subcircular foramen, underneath which there is a very small deltidium. Dorsal valve differing little from the ventral in contour, except that it has a mesial fold instead of sinus, and a smaller and entire beak.

The finer surface markings are very imperfectly preserved, nearly the whole of the outer layer of the test of the specimens collected being exfoliated. Both of the valves, however, are marked with radiating plications, which vary in shape, number and disposition in different individuals. Thus, in the specimen represented by fig. 6 there are three strongly developed subangular plications in the ventral valve, one in the centre of the sinus and one forming each of its outer limits, and four on the dorsal, i.e., two on the mesial fold and one on each side of it. All of these plications, in this as in other specimens, are obsolete on the umbo of each valve, and most prominent around the front margin. In the original of fig. 7 the two plications on the mesial fold of the dorsal valve trifurcate before reaching the front margin, and there is a very short marginal fold intercalated between them. There are three faint but continuous plications on each side of the fold and sinus, so that round the front margin of this specimen as many as thirteen plications can be counted on the dorsal valve, and there are eleven on the ventral. Lastly, in yet another specimen (fig. 8) there are two rather broad, rounded and continuous plications on the mesial fold of the dorsal, and three in the sinus of the ventral (one in its centre and one forming each of its outer boundaries), but there are no lateral plications. Upon the only specimen in which any portion of the outer layer of the test is preserved, the surface of the latter is seen to be marked by narrow radiating raised lines of very small but unequal size, which are crossed by narrower concentric raised lines, the latter

being very closely and regularly disposed, as well as slightly undulating when viewed with a lens.

Characters of the interior unknown, though in some specimens there are indications of a mesial septum in the dorsal valve, which appears to have extended from the beaks about half way to the front margin.

The dimensions of the three specimens figured are as follows:—The one represented by fig. 6, length, twelve millimetres; breadth, fourteen mm. and a half; thickness, six mm. and a half: by fig. 7, length, eleven mm. and a half; breadth, fifteen mm.; thickness, four mm., and a half: and by fig. 8, length, fifteen mm.; breadth, sixteen mm.; and thickness, nine.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: fifteen separate specimens and a small piece of rock consisting of an agglomeration of many others.

As the characters of the interior of the valves are unknown, it is of course doubtful to what genus this species should be referred. It is here provisionally regarded as an *Eatonia* on account of the strong resemblance that the specimens bear externally to some forms of the *E. medialis* of the Lower Helderberg limestone of the State of New York, of which it is just possible that they may prove to be a dwarf variety.

Pentamerus galeatus, Dalman. Var.

Plate 30, fig. 2.

Atrypa galeata, Dalman. 1827. Konigl. Vetens. Acad. Handlingar, p. 130.
Pentamerus galeatus, Davidson. 1865. Mon. Brit. Silur. Brach., p. 145 (which see for a full list of synonyms of this species up to date), pl. xv, figs. 13-23.
Pentamerus galeatus, Zittel. 1883. Handbuch der Palæont., vol. I, p. 603, fig. 534.

Mackenzie River, at the "Ramparts" R. G. McConnell, 1888: a single and apparently somewhat immature specimen, which, however, is strikingly similar to the Devonian variety of *P. galeatus*, from Gerolstein on the Eifel, figured by Zittel in the volume cited above. It differs from *P. comis*, Owen (which is possibly only another variety of *P. galeatus*), principally in the greatly produced umbo and strongly recurved beak of its ventral valve. The shallow mesial sinus in the front of its dorsal valve is bent abruptly inward at almost a right angle to the rest of the valve and bears a single faint plication in the middle,

while the feebly developed mesial fold in its ventral valve is biplicated near the front, where the two folds are divided by a short groove. On each side of the mesial fold and sinus there are two or three very faint and short marginal plications.

In Europe *P. galeatus* has long been recognized as a Devonian as well as a Silurian fossil, but it does not seem to have been previously recorded as occurring in the Devonian rocks of North America.

STRINGOCEPHALUS BURTINI, Defrance.

Plate 29, figs. 10, 10a, 11 and 11a.

Stringocephalus Burtini, Defrance. 1827. Dict. des Sc. Nat., vol. LI, p. 102, et Atlas, pl. lxxv, figs, 1, 1a.

Terebratula porrecta, Sowerby. 1827. Min. Conch., pl. 576, fig. 1.

Stringocephalus Burtini, Davidson. 1865. Mon. Brit. Devon. Brach., p. 11 (which see for a complete list of synonyms of the species), pl. i, figs. 18-22, and pl. ii, figs. 1-11.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: two casts of the interior of the closed valves, both of which are figured.

One of these (figs. 10, 10a) is of the normal shape and of moderate convexity. Its dimensions are:—length, not quite two inches and three quarters; breadth, a little over two inches and three quarters; thickness through the closed valves, exclusive of the test, about one inch and three quarters. The dorsal valve is somewhat more convex than the ventral, the thickness through the closed valves is much less than their breadth or height, and the umbo and beak of the ventral are prominent and nearly straight. The other (figs. 11 and 11a) which is somewhat distorted, represents an unusually globose form of the species, with the umbo of the ventral valve depressed and its beak closely recurved over that of the dorsal. The approximate dimensions of this specimen are:—length, two inches and a half, breadth, not quite as great; thickness through the closed valves, exclusive of the test, which is not preserved, two inches and a quarter. The test of this specimen seems to have been thick, judging by portions of it that are left in the matrix from which the cast figured was broken.

CRYPTONELLA CALVINI (?) Hall and Whitfield.

Cryptonella Calvini, Hall and Whitfield. 1870. Twenty-third Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 239.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888, a few

small specimens in a piece of limestone; and Peace River, at Vermilion Falls, R. G. McConnell, 1889, one adult and nearly perfect specimen, all of which are probably referable to this species. The only adult specimen is certainly "much less ventricose than *C. Eudora*" of the Chemung sandstones of the State of New York, and approaches more nearly in lateral outline to *C. planirostrata*. Its dorsal valve is much flatter than the ventral, and its greatest breadth is, if anything, rather behind than in front of the midlength.

NEWBERRIA, Hall. (Gen. Nov.)

"Diagnosis.—Shells elongate-ovoid, having the general contour and external aspect of RENSSELÆRIA and AMPHIGENIA, but without the strongly radiate-striate surface of the former genus. The convexity of the valves is greatest in the umbonal region, and the surface is distinctly flattened over the lateral slopes, leaving the median portion of the valves very prominent.

The pedicle-valve has the rostrum produced and incurved; the apex truncated by a circular foramen; deltidial plates not determined. The teeth are comparatively small, projecting forward and gently upward, free at their extremities, and supported by narrow dental plates, which join the interior of the valve above the middle of its depth and are continued forward as slender ridges upon the inner surface, which gradually merge into the shell.

In the bottom of the rostral and umbonal cavity there is a broad, scarcely defined muscular area, from which radiate a series of vascular ridges and depressions: the strongly marked pair of diductors are situated posteriorly, just within this muscular area; lying in front of these is a single (rarely subdivided) elongate adductor impression which often extends forwards to the centre of the shell.

On each side of the muscular impressions is a thickened triangular area, very narrow at its origin in the umbonal region, widening anteriorly and produced into two divergent furrows (four in all) which extend over the pallial region in some instances almost to the anterior margin.

In the brachial valve there are two short divergent crural plates, which are not united at their bases to form a hinge plate as in RENSSELÆRIA. A low median ridge arises between them, passing for a short distance along the bottom of the valve, separating the obovate narrowly flabelliform muscular scars of the adductor muscles. These scars are characterized by the strong striation of their surfaces.

Surface smooth or with obscure radiating striæ.

Shell substance punctate. (?)

Dedicated to John S. Newberry, M.D., LL.D., Professor of Geology and Palæontology in the School of Mines, Columbia College, New York, and lately State Geologist of Ohio, as a mark of appreciation of his high scientific attainments, and in remembrance of a friendship which has continued uninterrupted during fifty years.

Type: *Rensselæria Johanni*, Hall.

Observations.—Several species of RENSSELÆRIA have an essentially similar form, but they are always marked by strong radiating striæ, which, as far as observed, are obscure, or visible in specimens of NEWBERRIA only in partial exfoliation of the surface, very much as they appear in AMPHIGENIA. On the interior of the pedicle valve RENSSELÆRIA preserves two broad, strong, dental plates which reach nearly to the bottom of the rostral and post-umbonal cavity, leaving a narrow space for the muscular area, quite unlike that of the corresponding valve of NEWBERRIA. It is from this narrow cavity, produced by the encroachment of these strong dental plates, that we have the narrow elongate rostral casts of RENSSELÆRIA, which are very dissimilar to those of NEWBERRIA.

In the brachial valve the thickened strong hinge plate of RENSSELÆRIA which supports the crura, does not exist in species of NEWBERRIA, and in the latter genus we have no knowledge, thus far, of the existence of any interior loop or plate, as in RENSSELÆRIA. The external form and surface characters of NEWBERRIA are very similar to those of AMPHIGENIA, but the interior of the latter shell carries a spondylium or spoon-shaped process, an organ not present in NEWBERRIA nor in RENSSELÆRIA.

Species of NEWBERRIA are known to occur in the Devonian rocks near Davenport, Iowa; in Manitou county, Missouri; and on the Mackenzie River."

(Professor James Hall, communicated in a letter dated February 5, 1891.)

NEWBERRIA LÆVIS, Meek. (Sp.)

Plate 30, figs. 3, 4 and 4a.

Rensselæria lævis, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 108, pl. xiii, fig. 8, and pl. xiv, fig. 4.

Not *Rensselæria lævis*, Hall. 1859. Pal. St. N. Y., vol. III, p. 256, pl. xl, figs. 2 a-b.

Mackenzie River, at the "Ramparts," and ten miles below the Ram-

parts, R. G. McConnell, 1888: several nearly perfect specimens with the test preserved, the largest of which is fully two inches and three quarters in length, and a single cast of the interior of both valves, the original of fig. 3. These have been examined and critically studied by Professor Hall, and are here placed in the genus *Newberria* entirely on his authority.

PELECYPODA.

PTERINOPECTEN. (Sp. undt.)

Athabasca River, ten miles below the mouth of the Clear Water, Dr. R. Bell, 1882, two specimens, and R. G. McConnell, 1890, three specimens, all of which are too imperfect to be identified or described.

PTERINEA FLABELLUM, Conrad.

Avicula flabella, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, p. 238, pl. xii, fig. 8.
" " Vanuxem. 1843. Geol. Surv. N. Y., Rep. Third Distr.
Pterinea flabella, Hall. 1884. Pal. St. N. Y., vol. V, pt. 1, p. 93, pl. xiv, figs. 1-21, pl. xv, figs. 1, 4-6, 8-10, and pl. lxxxiii, figs. 11, 12.
Comp. *Pterinea fasciculata*, Goldfuss. 1840. Petref. German., p. 137, pl. cxx, fig. 5.
Pterinea fasciculata, Drs. G. and F. Sandberger. 1856. Verstein. Rhein. Schichtensyst. Nassau, p. 293, pl. xxx, fig. 7.
Pterinea costulata, F. A. Ræmer. Dunker and Von Meyer, Palæontographica, Bd. ii, S. 3, Taf. 1, fig. 3.

Peace River, at Vermilion Falls, R. G. McConnell, 1889: two nearly perfect and well preserved left valves.

It seems to be doubtful whether *P. flabellum* is identical with the *P. fasciculata* of Goldfuss or not. In his first and second report as palæontologist to the State of New York, Conrad himself quotes *P. fasciculata* as one of the fossils of that state, though in his subsequent description of *Avicula flabella* he makes no reference whatever to its resemblance to Goldfuss' species. On page 293 of their monograph of the fossils of the Devonian rocks of Nassau, the Sandbergers place *P. flabellum*, of which they state that they have received an original example (" original exemplar") from the Hamilton Group of the State of New York, from Hitchcock, — among the synonyms of *P. fasciculata*.

ACTINOPTERIA BOYDII, Conrad. (Sp.)

Avicula Boydii, Conrad. 1842. Jour. Ac. Nat. Sc. Phil., vol. VIII, p. 237, pl. xii, fig. 4.
Avicula quadrula, Conrad. 1842. Ib., p. 243, pl. xiii, fig. 5.
Pterinea Boydii, Conrad. S. A. Miller. 1877, in Cat. Am. Pal. Foss., p. 201.
Actinopteria Boydi, Hall. 1884. Pal. St. N. York, vol. V, pt. 1, p. 113, pl. xix, fig. 2-24, 26-30, and pl. lxxxiv, figs. 16 and 17.

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: one imperfect but well preserved and characteristic left valve.

PTYCHOPTERIA ÆQUIVALVIS. (N. Sp.)

Plate 32, figs. 6 and 6a.

Shell of medium size, equivalve, rather strongly convex in the umbonal region, the umbonal convexity in each valve extending to the anterior end of the base, abruptly inflected into the anterior wing and narrowing much more gradually into the posterior alation: greatest thickness a little more than half the maximum length. Height and length very nearly equal, the greatest length being at the hinge line, whence the valves narrow downwards to the somewhat pointed basal margin, which is narrowly rounded on its anterior side but much more broadly convex posteriorly. Anterior wing comparatively large and distinctly angulated at its outer extremity: posterior wing about twice as long as the anterior, not separated from the central portion of the valves by any alar groove or plication, but consisting of a mere upward expansion of the post-umbonal slope, its outer termination nearly rectangular but very slightly produced. Cardinal area very narrowly pyriform in front of the beaks and linear lanceolate behind them. Umbones prominent, rather broad, and placed a little in advance of the midlength, beaks curved inward, downward and a little forward.

Surface marked by extremely numerous and minute radiating impressed lines or narrow grooves. On the umbonal region and posterior wing some of these grooves are comparatively coarse and distant, with much finer ones intercalated between them, but on the anterior wing all the radiating grooves are of nearly uniform size and very closely disposed. On the anterior wing also the radiating grooves are crossed by very minute but distinct and close set concentric raised lines, which are absent on the umbonal region or central portion of the valves and very feebly developed on the posterior wing.

Dimensions of the only specimen collected, maximum length, estimated at twenty seven millimetres; greatest height, twenty five mm.; maximum thickness through the closed valves, a little over sixteen mm. (16.3 mm.)

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: one nearly perfect and well preserved specimen, with both valves.

This species would seem to be a very aberrant member of the genus *Ptychopteria*, for its shell is equivalve and its posterior wing is devoid of any longitudinal fold or groove and merges imperceptibly into the umbonal convexity.

It appears to be most nearly related to the *P. expansa* of Hall,* from the Chemung Group of Pennsylvania, but its beaks are more nearly central, its posterior wing is not nearly so much produced above, and the surface markings of the two species are quite different.

Leptodesma Demus, Hall. (Var.)

Plate 32, fig. 7.

Leptodesma Demus, Hall. 1884. Pal. St. N. York, vol. V, pt. 1, Lamellibr., 1, p. 203, pl. xc, figs. 15 and 16.

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: a perfect left valve which is almost exactly similar in shape to the right valve of *L. Demus* figured by Hall (op. cit., pl. xc, fig. 15), except that its basal margin is not quite so narrowly rounded.

The types of *L. Demus* are stated to be from the Chemung Group of Lawrenceville, Tioga Co., Pa.

Leptodesma Jason, Hall.

Plate 32, fig. 8.

Leptodesma Jason, Hall. 1884. Pal. St. N. York, vol. V, pt. 1, Lamellibr., 1, p. 213, pl. xci, figs. 4-6.

Athabasca River, opposite La Saline, R. G. McConnell, 1890: a few good specimens, one of which has both of the valves preserved.

The types of *L. Jason* are also stated to be from the Chemung Group of Pennsylvania.

* Pal. State N. York, vol. V, pt. 1, Lamellibr., 1, (1884), p. 152, pl. xxiii, figs. 10 and 11.

PALÆONEILO. (Sp. Undt.)

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: a cast of the interior of the closed valves of a narrowly elongated species of this genus, shewing impressions of numerous cardinal teeth.

The specimen is much too imperfect to be identified, but it seems to have been very similar in shape to the *P. attenuata* of Hall,* from the Waverly Group of Ohio.

PARACYCLAS ELLIPTICA, Hall.

Paracyclas elliptica, Hall. 1843. Geol. Surv. N. Y., Rep. Fourth Distr., p. 171, t. 67, fig. 2.
Lucina elliptica, Billings. 1859. Hind's Rep. Assinib. and Saskatch. Expl. Exp., p. 187, fig. 1d.
Lucina (*Paracyclas*) *elliptica*, Hall, var. *occidentalis*, Hall and Whitfield. 1872. Twenty fourth Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 189.
Paracyclas elliptica, Hall. 1885. Pal. N. Y., vol. V, pt. 1, Lamellibr., pt. 2, p. 440, pl. lxxvii, figs. 23-33, and pl. xcv, fig. 18.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: three specimens. Mackenzie River, at the "Ramparts," (five specimens), and ten miles below Bear River (one specimen); R. G. McConnell, 1888.

All the specimens collected are more or less well preserved casts of the interior of the closed valves. Those from the Mackenzie River belong to the large and rather inflated form of the species which Professor Hall once separated as the variety *occidentalis*, but specimens precisely similar to these are abundant in the Corniferous limestone of Ontario. The specimens from the Hay River are quite small.

SCHIZODUS CHEMUNGENSIS, Conrad.

Plate 30, figs. 5, 5a.

Nuculites Chemungensis, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, p. 247, pl. xiii, fig. 13.
Schizodus Chemungensis (Conrad) Hall. 1870. Prelim. Not. Lamellibr., 2, p. 96.
" " " " 1885. Pal. N. Y., vol. V, pt. 1, Lamellibr., pt. 2, p. 453, pl. lxxv, figs. 37-40, 45, 41.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a

* See Pal. St. N. York, vol. V, pt. 1, Lamellibr., ii, 1885, p. 346, pl. l, figs. 34-39.

cast of the interior of both valves, which very closely resembles the specimen of this species figured by Prof. Hall on plate lxxv, fig. 45, of volume five, part 1 (Lamellibranchiata,) of the Palæontology of the State of New York.

GASTEROPODA.

Euomphalus (Straparollus) inops, Hall.

Plate 31, fig. 3 and 3a.

Euomphalus inops, Hall. 1876. Illustr. Devon. Foss., Gasterop., pl. 16.
Euomphalus (*Straparollus*) *inops*, Hall. 1879. Pal. N. Y., vol. V, pt. 2, p. 58, pl. xvi, fig. 5.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: three specimens which agree remarkably well with the description and figure of the *E. inops* of Hall, from the Schoharie Grit of the State of New York, especially in the peculiar concavity of the unbilical area, though it must be born in mind that Prof. Hall's species was based upon a single imperfect cast of the interior of the shell and that its characters therefore are very imperfectly understood.

Euomphalus (Straparollus) flexistriatus. (N. Sp.)

Plate 31, figs. 2 and 2a.

Shell small, discoidal, spire depressed below the highest level of the outer volution. Volutions rather slender, coiled on nearly the same plane, contiguous and increasing gradually in size, their number uncertain, as nearly the whole of the inner ones are broken off in the only specimen collected, but probably, when entire, about three or four; outer volution compressed above and below and narrowly rounded on the periphery; umbilicus occupying nearly one-third of the entire diameter of the base; aperture transversely elliptical, its lower portion occupying a little more than one third of the entire basal diameter.

Surface marked by simple and flexuous transverse striæ of growth. On the base of the only specimen collected, commencing at the umbilical margin, these striæ at first curve gently and concavely backward, then obliquely forward and outward until they reach the centre of the periphery, after which their course cannot be traced, as they are not preserved on the upper side.

Maximum diameter, twenty three millimetres; width of umbilicus (as measured on the suture), eight mm.; longest diameter of aperture, nine mm.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one specimen.

This little shell seems to differ from the *Euomphalus inops*, *E. rudis* and *E. Hecale* of Hall in its depressed spire, and from the *E. clymenisides* of Hall (which is identical with the *Straparollus Canadensis* of Billings) in its smaller size, much less slender whorls and consequently narrower umbilicus.

Euomphalus Maskusi.* (N. Sp.)

Plate 31, fig. 4.

Shell rather large, discoidal, spire small, periphery flattened convex. Volutions four or five, coiled on nearly the same plane and increasing gradually in size, the inner ones, as seen from above, rounded, with a minute elevated apex, the two outer ones strongly angulated and bearing a single row of nodules or tubercles at their outer and upper margin. On the more perfect of the only two specimens collected the characters of the tubercles are shown only on the last volution but one. At its commencement they are quite minute and closely arranged, but, as they increase in size with great regularity, at its outer termination they are about three millimetres and a half in their largest diameter and somewhat quadrangular in outline. Characters of the lower or umbilical side and those of the aperture unknown. The only surface markings that happen to be preserved are a minute spiral impressed line in the centre of the nodulous keel bordering the periphery above, and an equally minute spiral raised line on each side of it.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two natural moulds of the exterior of the upper side of the shell. The figure on Plate 31 was drawn from and the foregoing description based on a gutta percha impression of the more perfect of these two moulds.

The species appears to have been very similar in size and shape to the *Euomphalus* (or *Pleuronotus*) *DeCewi* of Billings, from the Corniferous Limestone of Ontario, but in the former the outer margin of the last two volutions is tuberculated above and probably was so below.

* An abbreviation of the Cree name (Maskusikan sipi) for the Hay River.

Conularia Salinensis. (N. Sp.)

Plate 32, figs. 9, 9a.

Shell elongate-pyramidal, transverse section quadrangular, with the opposite sides equal and the alternate ones unequal; faces of the pyramid flattened, each marked with a rounded, narrow and longitudinal, median raised line.

In addition to this median line, the surface of each of the sides is crossed by rather regularly disposed, parallel and nearly equidistant, very narrow transverse ridges, which curve gently forward and are separated by flattened spaces whose width is rather more than twice the breadth of the ridges. When viewed under a lens, the summit of each ridge is seen to bear a single row of minute pustules, each of which is continued longitudinally forward across the flattened space next to it, as an externally minute linear prolongation. The pustules on any two immediately adjacent ridges are not opposite but alternate, so that the interior prolongations of the pustules are never continuous nor united, or confluent in such a way as to form continuous lines. On each of the sides, too, all the transverse ridges pass over the summit of the median raised line.

The only specimen collected, which though well preserved is somewhat distorted, is nearly perfect at the smaller end but broken at the larger. It actual length is about thirty millimetres. The whole of its flattened sides and a small portion of the other two are exposed, the remainder being buried in the matrix. Of the two sides which are fully exposed, the narrower one increases in breadth from two mm. at the smaller end to nine mm. and a half at a distance from it of twenty five mm., and the broader one from two mm. at the same end to thirteen mm. at a corresponding distance.

Athabasca River, opposite La Saline, R. G. McConnell, 1890: one specimen.

The discovery of this species and the elucidation of its characters, are entirely due to Mr. L. M. Lambe, who found the type specimen while breaking open a piece of argillaceous limestone containing *Leptodesma Jason*.

Its most characteristic feature seems to be the longitudinal raised line in the centre of each of its flattened sides.

CEPHALOPODA.

Orthoceras.

In the collection made by Mr. McConnell at the Hay River in 1887,

this genus is represented by two specimens. These are both much too imperfect for identification or description, but they clearly indicate the existence of two distinct species of *Orthoceras* in the Devonian rocks at this locality.

GYROCERAS.

A well preserved portion of what seems to have been the body chamber of a small, nodose and apparently undescribed species of *Gyroceras* was obtained by Mr. McConnell, in 1888, on the Mackenzie River, at the "Rock by the river side." In this specimen the sides are expanded, the venter and dorsum compressed, and the outline of the transverse section is obscurely octagonal, with the two angles on the dorsal side obsolete. The surface markings consist of distant nodes, arranged in longitudinal and transverse rows, and connected in both directions by obscure ridges. In each transverse row there are six of these nodes.

On the Peace River, at Vermilion Falls, a very imperfect cast of a considerable portion of the interior of the shell of the outer volution of another and very different species of *Gyroceras* was collected by Mr. McConnell in 1889. This specimen, which is of considerable size, seems to be most nearly related to the *G. submamillatum*, from the Devonian rocks of Lake Winnipegosis,* and may possibly be referable to that species, though it does not show any indications of a row of large and low rounded promiences on either of its sides.

GONIATITES.

Plate 31, fig. 5.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a cast of the interior of three chambers of the septate portion of the shell of a species of *Goniatites*, in which only the lateral lobes and saddles are preserved, each ventral lobe being completely obliterated by weathering. So far as can be ascertained from such an imperfect specimen, the species appears to have the closest affinities with the *G. Ixion* of Hall,† from the Goniatite limestone of Rockford, Indiana, which is the type of Hyatt's genus *Brancoceras*.

* Trans. Royal Soc. Canada for 1890, Sect. iv, p. 107, pl. x, figs. 1 and 1a.
† Pal. St. N. Y., vol. V, pt. 2, p. 474, pls. lxxiii, figs. 12-14 and lxxiv, fig. 12.

CRUSTACEA.

OSTRACODA.

PRIMITIA SCITULA, Jones.

Primitia scitula, Jones. 1891. Contr. to Can. Micro-Pal., vol. I, pt. 3,* pl. xi, figs. 14a and b.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two specimens, one on *Atrypa reticularis* and the other on *Strophodonta demissa*.

APARCHITES MITIS, Jones.

Aparchites mitis, Jones. 1891. Contr. to Can. Micro-Pal., vol. I, pt. 3, pl. xi, figs. 15a and b.

Athabasca River,—within twenty miles of the Clearwater, A. S. Cochrane, 1881, and three miles below the Calumet, R. G. McConnell, 1890. Hay River, forty miles above its mouth, R. G. McConnell, 1887. One or two specimens from each of these localities.

ISOCHILINA BELLULA, Jones.

Isochilina bellula, Jones. 1891. Contr. to Can. Micro-Pal., vol. I, pt. 3, pl. xi, figs. 16a and b.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two specimens.

TRILOBITA.

PROETUS HALDEMANI, Hall.

Plate 31, figs. 6-8.

Proetus Haldemani, Hall. 1861. Descr. New Species of Fossils, etc., p. 74.
" " " 1862. Fifteenth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 102.
" " Hall. 1876. Illustrations of Devonian Fossils, pl. xxi, figs. 7-9.

* Now in the printer's hands, but not yet paged.

Dechenella Haldemani, Kayser. 1880. Zeitschrift der Deutsch Geol. Gesellsch., p. 707, pl. xxvii, fig. 9.

Proetus Haldemani, Walcott. 1884. Pal. Eureka distr. Nevada, p. 210.

(?) *Dechenella Haldemani*, Tschernyschew. 1887. Mem. du Comité Geol., vol. III, No. 3, p. 14, pl. i, fig. 9.

Proetus Haldemani, Hall. 1888. Pal. St. N. Y., vol. VII, p. 113, pl. xxi, figs. 7-9 and pl. xxiii, figs. 13-15.

Mackenzie River, at Grand View, several well preserved specimens, and at the "Ramparts," one badly preserved pygidium, R. G. McConnell, 1888. The specimens from Grand View consist of two separate heads, one head and thorax, two separate tails and three with the thorax attached, also of a small flat piece of limestone with one of its surfaces strewn with seven pygidia, one head and the thoracic segments of three individuals of this species.

In the following lists the species are arranged according to the localities at which they were collected, following the general direction of the drainage of the Mackenzie River and its tributaries, from the south-east to the north-west.

Pembina River, four miles above its mouth.

Spirifera inutilis, Hall.
Atrypa reticularis, var. aspera.

Clearwater River, east bank, about four miles below the Pembina.

Orthis striatula, Schlotheim.
Atrypa reticularis, L.
Spirorbis omphalodes, Goldfuss.
Ascodictyon stellatum, Nicholson.

Athabasca River, first ten miles below the mouth of the Clearwater.

Chonetes Logani, var. Aurora, Hall.
Strophalosia productoides, Nicholson.
Spirifera tullia, Hall. Var.
Athyris Angelica, var. occidentalis, W.
Atrypa reticularis.
Atrypa reticularis, var. aspera.
Actinopteria Boydii, Conrad.
Ptychopteria æquivalvis, W.
Leptodesma Demus, Hall.

Athabasca River, opposite La Saline and about twenty five miles below the mouth of the Clearwater.

Chonetes Logani, var. Aurora.
Strophalosia productoides.
Productella dissimilis, Hall.
Spirifera subattenuata, Hall.
" inutilis.
" tullia. Var.
Spirifera (Martinia) Richardsoni, M
Atrypa Angelica, var. occidentalis.
Atrypa reticularis.
Leptodesma Jason, Hall.
Conularia Salinensis, W.
Aparchites mitis, Jones.

Athabasca River, three miles below the mouth of the Calumet and eighteen miles below the mouth of Red River.

Cyathophyllum Athabascense, W.
Spirorbis omphalodes.
Hederella Canadensis, Nicholson.
Ascodictyon stellatum.
Crania Hamiltoniæ, Hall.
Productella dissimilis.
Orthis striatula.
Strophodonta demissa, Conrad.
Spirifera subattenuata.
" inutilis.
Cyrtina Hamiltonensis, Hall.
Athyris parvula, W.
Atrypa reticularis.
" " var aspera.
Rhynchonella pugnus, Martin.
Aparchites mitis.

Athabasca River, thirty miles below Red River.

Campophyllum ellipticum, var.
Ascodictyon stellatum.
Productella dissimilis.
Orthis striatula.
Strophodonta demissa.
Spirifera subattenuata.
Spirifera inutilis.
Cyrtina Billingsi, Meek.
Athyris parvula.
Atrypa reticularis.
" " var. aspera.

Peace River, between Vermilion Falls and the mouth of the Little Red River.

Cyathophyllum cæspitosum, Goldfuss.
Phillipsastræa Hennahi, Lonsdale.
Pachyphyllum Devoniense, Edw. & H.
Pachypora cervicornis, DeBlainville.
Alveolites vallorum, Meek.
Alveolites Roemeri, Billings.
Monotrypella Unjiga, W.
Strophodonta demissa.
Strophodonta perplana, Conrad.
Spirifera disjuncta, Sowerby.
Atrypa reticularis.
" " var. aspera.
Rhynchonella cuboides, Sowerby.
Cryptonella Calvini? Hall.
Pterinea flabellum, Conrad.

Peace River, at Rapid Bouillé.

Strophodonta demissa.

Peace River, at "Fossil Point."

Spirifera disjuncta.
Rhynchonella pugnus.

Hay River, forty miles above its mouth.

Astræospongia Hamiltonensis, M. & W.
Aulopora serpens, Goldfuss.
Cyathophyllum cæspitosum.
Campophyllum ellipticum.
Heliophyllum parvulum, W.
Phillipsastræa Hennahi.
" Verrillii, Meek.
Alveolites vallorum.
Arachnocrinus Canadensis, W.
Spirorbis omphalodes.
" Arkonensis, Nicholson.
Cornulites (Ortonia) subhevis, W.
Hederella Canadensis, Nicholson.
Proboscina laxa, W.
Stomatopora moniliformis, W.
Ascodictyon stellatum.
Paleschara quadrangularis, Nicholson.
Ceramopora Huronensis, Nicholson.
Crania Hamiltonia.
Productella spinulicosta, Hall.
Orthis striatula.
Strophodonta demissa.
Spirifera disjuncta.
" " var. occidentalis, W.
Spirifera cyrtinæformis, Hall & Whitfield.
Spirifera (M) glabra, var. Franklini.
Atrypa reticularis.
" " var. aspera.
Rhynchonella cuboides.
Eatonia variabilis, W.
Paracyclas elliptica, Hall.
Schizodus Chemungensis, Conrad.
Euomphalus Maskusi, W.
Primitia scitula, Jones.
Aparchites mitis, Jones.
Isochilina bellula, Jones.

Mackenzie River, at the "Rock by the river side," twenty miles below Fort Wrigley.

Chonetes Logani, var. Aurora.
Productella subaculeata, var. cataracta.

Mackenzie River, ten miles below the mouth of Bear River.

Streptelasma rectum, Hall.
Paracyclas elliptica.

Mackenzie River, at the "Ramparts."

Cyathophyllum arcticum, Meek.
Cyathophyllum (Aulophyllum) Richardsoni, M.
Pachypora cervicornis.
Alveolites vallorum.
Spirorbis omphalodes.
Cornulites (Ortonia) subhevis.
Hederella Canadensis.
Paleschara quadrangularis.
Chonetes Logani, var. Aurora.
Productella lachrymosa, var. lima, Con.
Orthis striatula.
Spirifera (M.) glabra, var. Franklini.
Spirifera (M.) meristoides, Meek.
Atrypa reticularis.
" " var. aspera.
Rhynchonella pugnus.
" castanea, Meek.
Pentamerus galeatus, Dalman.
Stringocephalus Burtini, Defrance.
Cryptonella Calvini? Hall & Whitfield.
Newberria lævis, Meek (Sp.)
Euomphalus inops, Hall.
" flexistriatus, W.
Proetus Haldemani, Hall.

Mackenzie River, at "Grand View," forty five miles below the "Ramparts."

Productella spinulicosta.	Proetus Haldemani.
Atrypa reticularis.	

According to Mr. McConnell, a section of the Devonian rocks in the Mackenzie River district, in descending order, would be somewhat as follows:—

1. Upper limestone ..... (about) 300 feet.
2. Greenish and bluish shales, alternating with limestone ..... (about) 500 feet.
3. Greyish limestone, interstratified with dolomites, the lower part of which may be older than the Devonian ..... 2000 feet (or more.)

The whole of the fossils referred to in this Report are from the upper part of the middle division of this section. Although some of the localities* at which these fossils were collected are very far apart, the writer is informed by Mr. McConnell that the lithological characters and stratigraphical relations of the shales and limestones at each are almost identical. The fossil faunæ at the whole of these localities seem to show similarly close relations, and it is most probable that all the species in the foregoing lists are from practically the same geological horizon.

An analysis of these lists shows that twenty two of the species are found also in the Hamilton Formation of Ontario or the State of New York.

These are:—

Astræospongia Hamiltonensis.	Cerampora Huronensis.
Aulopora serpens.	Crania Hamiltoniæ.
Streptelasma rectum.	Chonetes Logani, var. Aurora.
Pachypora cervicornis.	Strophodonta demissa.
Alveolites Roemeri.	" perplana.
Spirorbis omphalodes.	Productella spinulicosta.
" Arkonensis.	Atrypa reticularis.
Cornulites (Ortonia) sublævis.	Cyrtina Hamiltonensis.
Hederella Canadensis.	Pterinea flabellum.
Ascodictyon stellatum.	Actinopteria Boydii.
Paleschara quadrangularis.	Proetus Haldemani.

* The Ramparts, on the Mackenzie, for instance, are 570 miles from the locality on the Hay River at which fossils were collected, and nearly 1,000 miles from La Saline on the Athabasca.

Ten of the species occur also in Iowa, in beds that are now referred to the Chemung.

These are:—

Campophyllum ellipticum.	Spirifera cyrtiniformis.
Hederella Canadensis.	Atrypa reticularis.
Productella dissimilis.	" " var. aspera.
Orthis striatula. (=O. Iowensis.)	Rhynchonella pugnus. (=R. alta.)
Strophodonta demissa.	Cryptonella Calvini.

Seven are identical with species that are said to be characteristic of the Chemung of the States of New York and Pennsylvania.

These are:—

Productella lachrymosa, var. lima.	Leptodesma Demus.
Spirifera disjuncta.	" Jason.
Athyris Angelica.	Schizodus Chemungensis.
Rhynchonella cuboides. (venustula.)	

In the Mackenzie River district, however, the subdivisions of the Devonian System that exist in the State of New York and Ontario are probably not recognizable, and there are strong reasons for supposing that the whole of the fossils reported upon in these pages belong to the "Cuboides Zone."

It is true that *Rhynchonella cuboides* itself has so far been found only on the Peace and Hay Rivers, where it is invariably associated with *Spirifera disjuncta* (or *Verneuili*), but other fossils eminently characteristic of the Cuboides Zone will be noticed in nearly all the foregoing lists of species from the Athabasca and its tributaries or from the Mackenzie.

In a paper published as a Bulletin of the Geological Society of America and dated May, 1890, Prof. H. S. Williams cites three species, which, according to Meyer, are the "principal fossils of the Cuboides Schichten" in Europe, and thirteen others as "conspicuous fossils in its fauna." Of the first three, two are *Rhynchonella cuboides* and *Spirifera disjuncta* (or *Verneuili*,) which, as before stated, occur together at the Peace and Hay Rivers. Of the thirteen others, five, viz., *Productella subaculeata, Orthis striatula, Atrypa reticularis, Rhynchonella pugnus* and *Pentamerus galeatus* are found in one or other of the lists of species on pages 247–50. *Pachypora cervicornis*, too, which was collected at the "Ramparts" by Mr. R. W. McFarlane in 1857, and *Strophalosia productoides*, which has since been found by Dr. Bell and Mr. McConnell in the Devonian rocks of the Athabasca, are both stated to be characteristic of the Cuboides Zone in Europe. The *Cyathophyllum hexagonum* of the Cuboides Zone of Belgium is represented at the "Ramparts" by

C. arcticum, and the *Spirifera concentrica* of the same zone and locality, by the *Athyris parvula* of the Athabasca, which is little more than a diminutive race of *S. concentrica*.

Prof. Williams correlates the Cuboides Zone of Europe with the Tully Limestone of the State of New York, together with certain "shaly strata several hundred feet above it." He suggests also that "if we wish to express precise correlation in our classification of American rocks, the line between middle and upper Devonian formations should be drawn at the base of the Tully Limestone, to correspond with the usage of French, Belgian, German and Russian geologists, who include the *Frasnien, Cuboides Schichten*, and correlated zones in the upper Devonian." For comparison with the fauna of the Cuboides Zone in Europe, Prof. Williams says that "the more important species in the Tully Limestone of New York are the brachiopods, of which he gives a list of thirteen. Of these, *Chonetes Logani*, var. *Aurora*, *Productella spinulicosta*, *Strophodonta perplana*, *Spirifera tullia*, *Cyrtina Hamiltonensis*, *Atrypa reticularis*, *Atrypa aspera* and *Rhynchonella venustula* (*cuboides*) occur also in the Devonian of the Mackenzie River district. The large variety of *Orthis Tulliensis*, from the Tully Limestone, figured by Prof. Williams, also, is practically indistinguishable from some of the specimens of *O. striatula* from the Athabasca River, Hay and Peace Rivers.

The occurrence of two specimens of *Stringocephalus Burtini*, associated with several examples of *Rensselaeria lævis*, Meek (not Hall), and the apparent absence of *Spirifera disjuncta*, at the "Ramparts," on the Mackenzie River, are, doubtless, rather suggestive of the "Stringocephalus limestone," but nearly all the other species found at this locality are characteristic of the Cuboides Zone as developed in Europe, or of its American representative the Tully Limestone.

Finally the following table has been prepared to shew the close resemblance which the fauna of the Devonian rocks of the Mackenzie River district, as exemplified in these pages, bears to that of the same formation in Europe or upon the European side of the Atlantic.

Mackenzie River District.	Europe.
Aulopora serpens.	Aulopora serpens.
Cyathophyllum arcticum.	Cyathophyllum hexagonum.
Cyathophyllum cæspitosum.	Cyathophyllum cæspitosum.
Cyathophyllum Athabascensis.	Cyathophyllum ceratites, Goldfuss.
Campophyllum ellipticum.	Campophyllum Seetenicum, Schluter.
Phillipsastræa Hennahi.	Phillipsastræa Hennahi.
Pachyphyllum Devoniense.	Pachyphyllum Devoniense.
Pachypora cervicornis.	Pachypora cervicornis.

Mackenzie River District.	Europe.
Spirorbis omphalodes.	Spirorbis omphalodes.
Stomatopora moniliformis.	Hippothoa Devonica, Ehlert.
Strophalosia productoides.	Strophalosia productoides.
Productella subaculeata, var. cataracta.	Productella subaculeata.
Productella spinulicosta.	Productella spinulicosta.
Orthis striatula	Orthis striatula.
Spirifera disjuncta.	Spirifera disjuncta.
Spirifera cyrtineformis.	Sp. aperturatus, var. cuspidatus.
Spirifera glabra, var. Franklini.	Spirifera glabra.
Spirifera Richardsoni, Meek.	Spirifera undifera, Rœmer.
Cyrtina Hamiltonensis.	Cyrtina heteroclita (Auct.)
Atrypa reticularis.	Atrypa reticularis.
Atrypa reticularis, var. aspera.	Atrypa reticularis, var. aspera.
Rhynchonella pugnus.	Rhynchonella pugnus.
Rhynchonella cuboides.	Rhynchonella cuboides.
Pentamerus galeatus.	Pentamerus galeatus.
Stringocephalus Burtini.	Stringocephalus Burtini.
Newberria levis, Meek. (Sp.)	Rensselæria amygdalina, Goldfuss (Sp.)
Pterinea flabellum.	Pterinea fasciculata, Goldfuss.
Paracyclas elliptica.	Lucina proavia, Goldfuss.
Proetus Haldemani, Hall.	Proetus Haldemani.

PLATE XXVII.

Unless otherwise stated, the figures in this and the following plates are of natural size.

STREPTELASMA RECTUM (page 199).

Figure 1. Side view of a specimen from the Mackenzie River.
Figure 1*a*. Outline of the anterior end of the same as seen from above.
Figure 2. Longitudinal section of another specimen from the same locality.

CYATHOPHYLLUM RICHARDSONI (page 200).

Figure 3. Side view of one of the specimens collected by Mr. McConnell.
Figure 4. Longitudinal section of another specimen.

CAMPOPHYLLUM ELLIPTICUM (page 202).

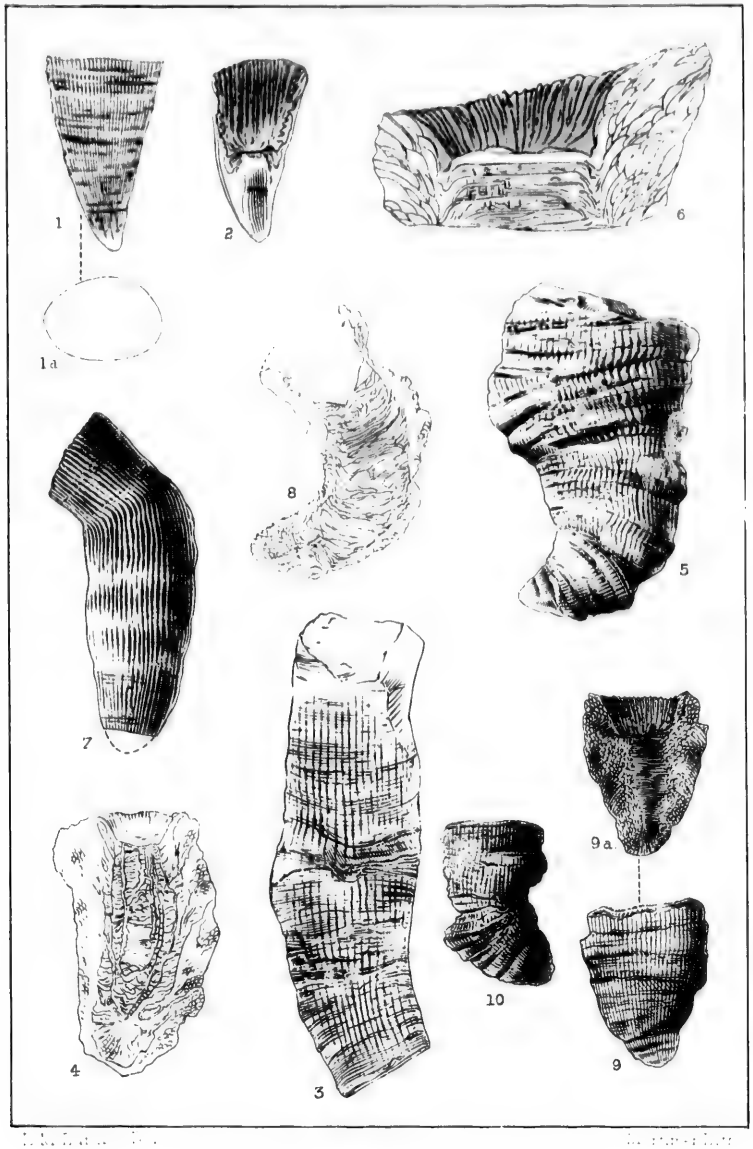
Figure 5. Side view of a specimen from the Hay River.
Figure 6. Longitudinal section of a large but imperfect specimen from the same locality.

CYATHOPHYLLUM CÆSPITOSUM (page 200).

Figure 7. Side view of a simple, or nearly simple, specimen from the Hay River. On the other side of this specimen, however, there is a single lateral bud.
Figure 8. Longitudinal section of another specimen from this locality.

HELIOPHYLLUM PARVULUM (page 203).

Figure 9. Side view of one of the types of this species, from the Hay River.
Figure 9*a*. Longitudinal section of the same.
Figure 10. Side view of another specimen from the Hay river.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1a
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PLATE XXVIII.

Astræosponcia Hamiltonensis (page 197).

Figure 1. A spicule from the Hay River, supposed to be referable to this species.

Figure 1*a*. The same, fourteen times the natural size.

Arachnocrinus Canadensis (page 208).

Figure 2. Lateral view of the dorsal cup of the only known specimen of this species. Twice the natural size.

Figure 2*a*. Diagram of the plates of the dorsal cup of the same. Four times the natural size.

Spirorbis omphalodes (page 209).

Figure 3. A small and probably immature specimen, as seen from above, with the outer volution rounded and somewhat depressed, and the umbilicus comparatively wide. Twelve times the natural size.

Figure 4. Similar view of a larger and probably adult example. The outer volution is elevated and subangulated, and the umbilicus rather narrow. Six times the natural size.

Figure 4*a*. Outline of the same, as viewed laterally.

Figure 5. Another specimen, in which the umbilical margin only is minutely plicated, as seen from above. Four times the natural size.

Figure 5*a*. Lateral outline of the same.

Cornulites (Ortonia) sublævis (page 210).

Figure 6. A calcareous tube of this species, as seen from above, with the outline of its aperture. Both three times the natural size.

Figure 7. Another tube of this species, also three times the natural size.

Hederella Canadensis (page 210).

Figure 8. A colony of this species, as seen from above.

Figure 8*a*. A portion of the same, three times the natural size.

Proboscina laxa (page 212).

Figure 9. The only specimen collected, as seen from above.

Figure 9*a*. A portion of the same, eight times the natural size.

Stomatopora moniliformis (page 212).

Figure 10. A colony of this species, as seen from above, and ten times the natural size.

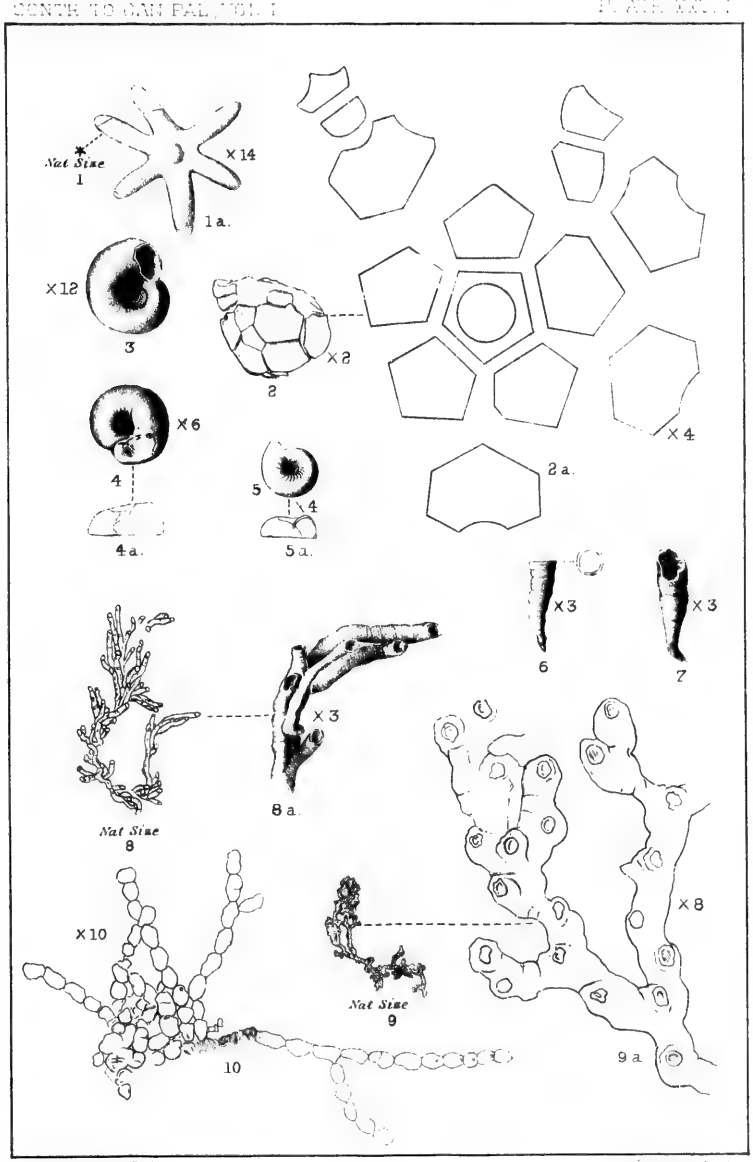

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PLATE XXIX.

AULOPORA FILIFORMIS, Billings, (page 211).

Figure 1. Side view of the only known specimen of this species, which has not previously been figured. Introduced for comparison.

CHONETES LOGANI, var. AURORA (page 215).

Figure 2. Ventral valve of a specimen from the Mackenzie River at the "Ramparts."

Figure 2*a*. Portion of the same, magnified four times, to show the surface ornamentation.

PRODUCTELLA SPINULICOSTA (page 217).

Figure 3. Dorsal view of a specimen from the Hay River, which is somewhat doubtfully referred to this species. Twice the natural size.

Figure 3*a*. Profile view of the same, also twice the natural size.

SPIRIFERA DISJUNCTA (page 221).

Figure 4. Dorsal view of a perfect and typical specimen from the Hay River.

SPIRIFERA DISJUNCTA, var. OCCIDENTALIS (page 222).

Figure 5. Dorsal view of a specimen from the Hay River.

Figure 5*a*. Profile view of the same.

EATONIA VARIABILIS (page 233).

Figure 6. Dorsal view of a specimen with the front margin subtruncated, and four plications on the dorsal valve.

Figure 6*a*. Profile view of the same.

Figure 7. Dorsal view of a specimen in which as many as thirteen plications can be counted on the regularly rounded front margin.

Figure 8. Dorsal view of a specimen in which there are only two central and no lateral plications in the dorsal, and in which the front margin of both valves is produced into a short rounded lobe.

Figure 8*a*. Profile view of the same.

Figure 9. Portion of the umbonal region of another specimen, to show the perforate beak of the ventral valve.

STRINGOCEPHALUS BURTINI (page 235).

Figure 10. Outline of the dorsal aspect of a cast of the interior of both valves of this species, of normal form.

Figure 10*a*. Outline of the same, in profile.

Figure 11. Dorsal view of another cast of the interior of a shell of this species, of unusually globose form, and in which the beak of the ventral valve is strongly recurved over that of the dorsal.

Figure 11*a*. Profile view of the same.

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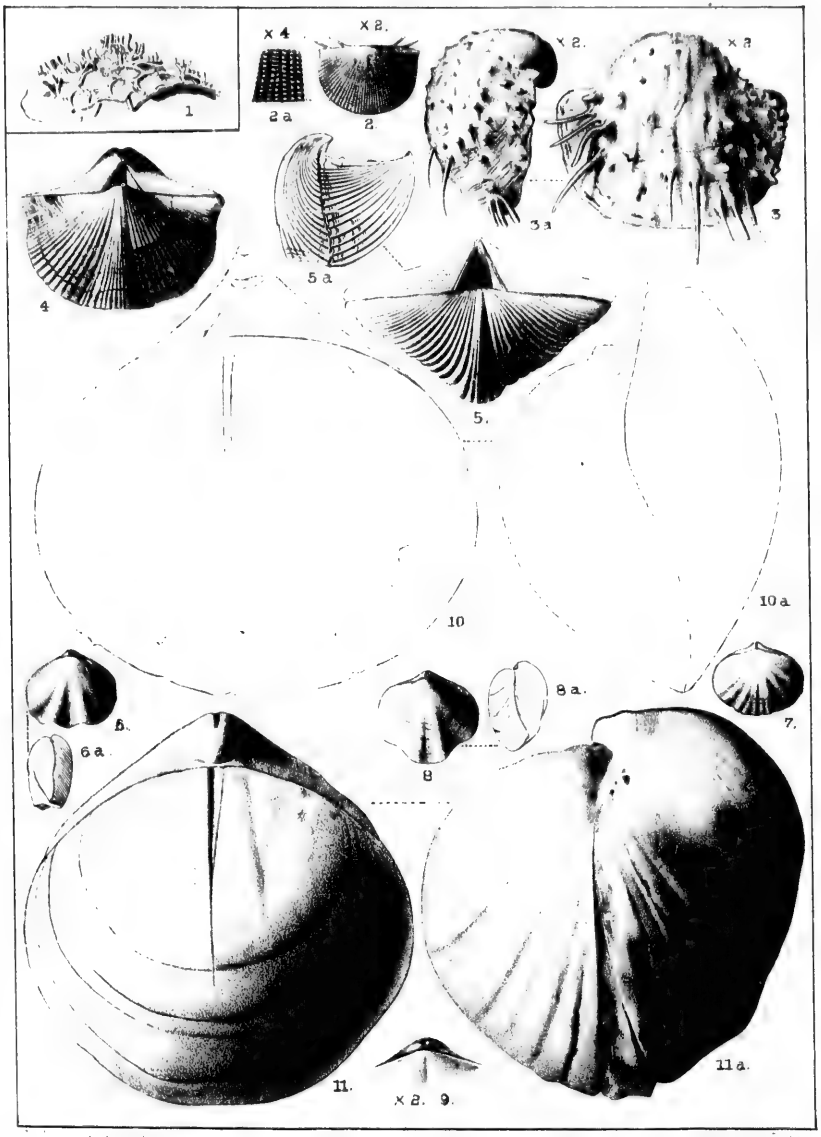

PLATE XXV.

Monotrypella Unjiga (page 214).

Figure 1. Terminal branchlet, natural size,
Figure 1*a*. Portion of the same, four times the natural size.
Figure 1*b*. Transverse section of a terminal branchlet, x 30.
Figure 1*c*. Longitudinal " " " " "
Figure 1*d*. Tangential " " " " "

Pentamerus galeatus (page 234).

Figure 2. Dorsal view of the specimen referred to in the text.

Newberria lævis (page 237).

Figure 3. Cast of the interior of the closed valves of a specimen of this species, shewing the characters of the dorsal valve.
Figure 4. Dorsal view of a specimen with the test preserved.
Figure 4*a*. Profile of the same, in outline.

Schizodus Chemungensis (page 241).

Figure 5. Side view of the specimen referred to in the text.
Figure 5*a*. Outline of the same, as seen from above.

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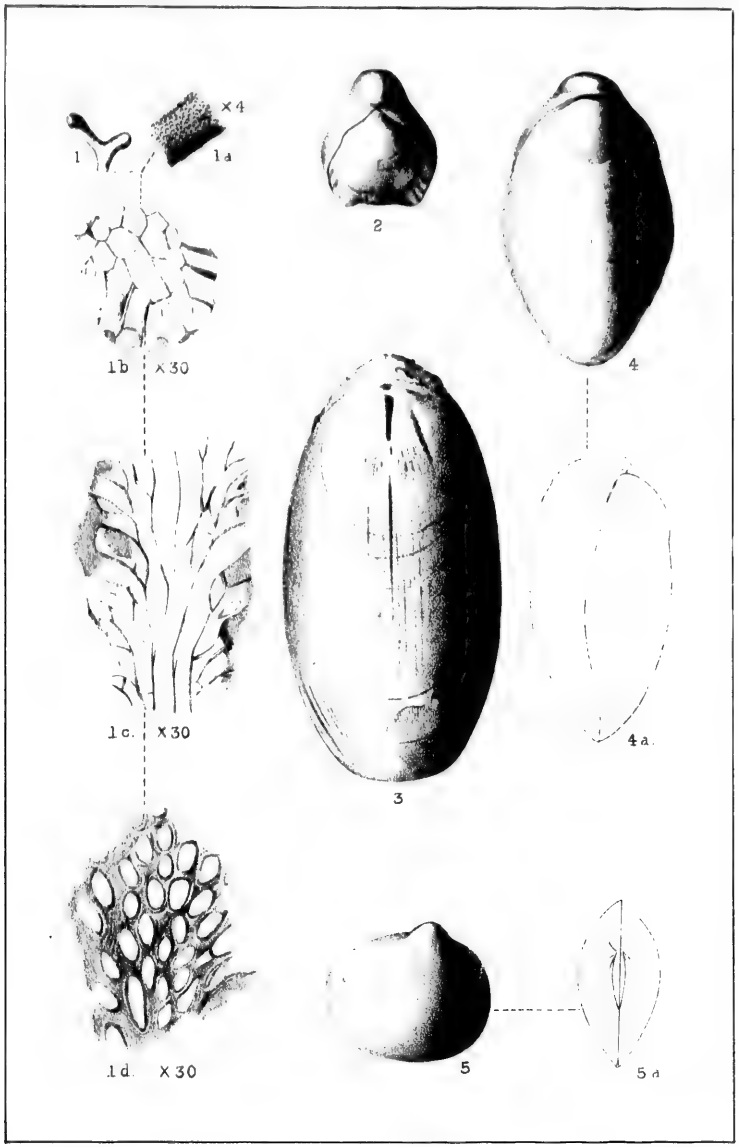

PLATE XXXI.

PRODUCTELLA SPINULICOSTA (page 217).

Figure 1. Outline of ventral valve of the specimen from the Mackenzie River at "Grand View," referred to in the text.

EUOMPHALUS (STRAPAROLLUS) FLEXISTRIATUS (page 242).

Figure 2. The type of this species, as seen from above.
Figure 2*a*. The same, as seen from below.

EUOMPHALUS (STRAPAROLLUS) INOPS (page 242).

Figure 3. Upper side of a specimen of this species from the Mackenzie River at the "Ramparts."
Figure 3*a*. Lower side of the same.

EUOMPHALUS MASKUSI (page 243).

Figure 4. View of the upper side of the most perfect specimen collected, drawn from a gutta percha impression taken from a natural mould of the exterior of the shell.

GONIATITES (page 245).

Figure 5. Side view of the specimen from the Hay River referred to in the text.

PROETUS HALDEMANI (page 246).

Figure 6. Outline of a head of this species, from the Mackenzie River at "Grand View," as seen from above.
Figure 7. Outline of united thorax and pygidium of a specimen from the same locality.
Figure 8. Outline of another head of this species, also from "Grand View."

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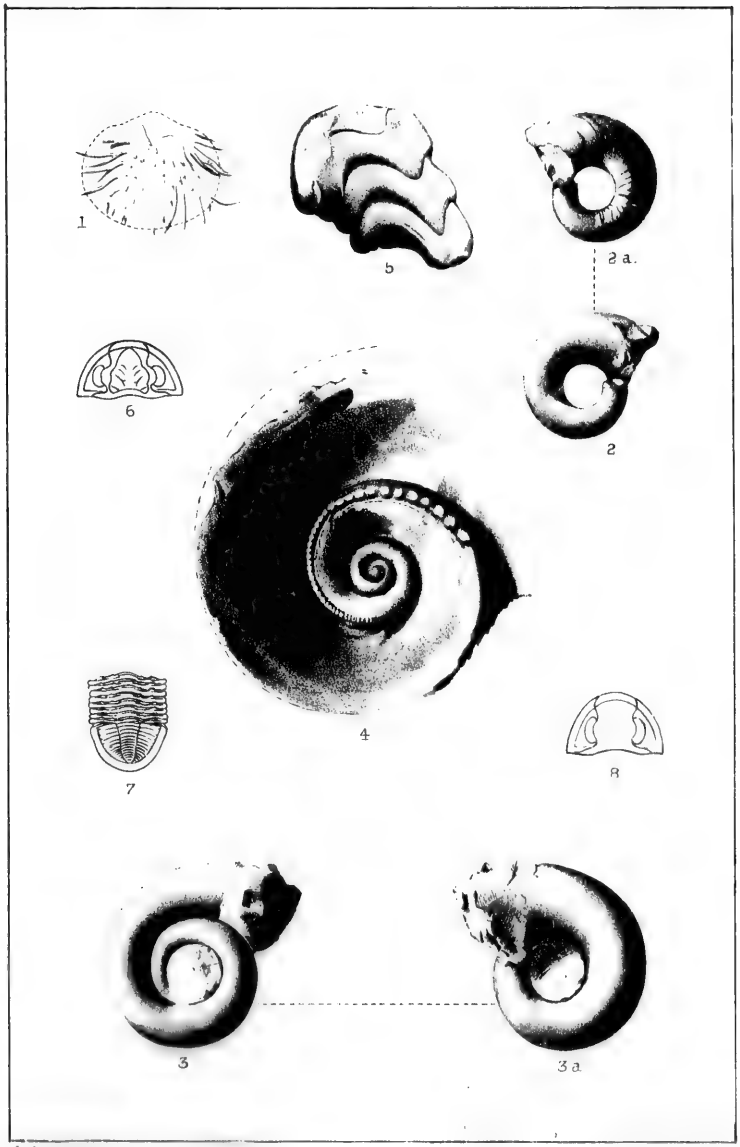

PLATE XXXII.

CYATHOPHYLLUM ATHABASCENSE (page 202).

Figure 1. Side view of the largest and most perfect specimen collected.
Figure 1*a*. Longitudinal section through the centre of the same.
Figure 1*b*. Transverse section of the same, below the base of the cup.

SPIRIFERA TULLIA (page 224).

Figure 2. Dorsal view of a specimen from the Athabasca River.
Figure 2*a*. Ventral view of the same specimen.
Figure 2*b*. Portion of the same, five times the natural size, to shew the surface ornamentation of the ribbed lateral areas.

ATHYRIS ANGELICA, var. OCCIDENTALIS (page 227).

Figure 3. Dorsal view of a specimen from the Athabasca River.
Figure 3*a*. Ventral view of the same.
Figure 3*b*. Front view of the same.

ATHYRIS PARVULA (page 228).

Figure 4. Dorsal view of a specimen from the Athabasca River, three miles below the Calumet, and referred to in the text as No. 1.
Figure 5. Similar view of a specimen from the Athabasca River, thirty miles below Red River, and referred to in the text as No. 2.
Figure 5*a*. Front view of original of fig. 5.

PTYCHOPTERIA ÆQUIVALVIS (page 239).

Figure 6. Side view of the type specimen.
Figure 6*a*. Cardinal view of the same, to shew the equal convexity of the two valves.

LEPTODESMA DEMUS (page 240).

Figure 7. A left valve of this species, from the Athabasca River.

LEPTODESMA JASON (page 240).

Figure 8. Lateral view of a specimen of this species, from the Athabasca River, showing only the left valve, though both are preserved.

CONULARIA SALINENSIS (page 244).

Figure 9. Side view of the only specimen collected.
Figure 9*a*. A portion of the same, five times the natural size.

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